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SECOND

ANNUAL REPORT

OF

SAPPORO

AGRICULTURAL COLLEGE

1878.

TOKEI

PUBLISHED BY THE KAITAKUSHI.


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Sapporo, March 25th. Anno 11th. of Meij.

KURODA KIYOTAKA,

Kaitaku Chiokwan.

Sir :— I have the honor herewith to transmit the Second Annual Report of the President of the Sapporo Agricultural College, with accompanying documents.

Kaitaku Gondaishiokikwan,

DZUSHIO HIROTAKE,

Director of Sapporo Ag'l. College.

Sapporo, Japan,
March 23d. 1878.

His Honor
DZUSHIO HIROTAKE,
Kaitaku Gondaishiokikwan,
Director Sapporo Ag'l. College.

Sir:—I now have the honor to transmit to the Department through Your Honor, the Director, the Second Annual Report of Sapporo Agricultural College.

With great respect,
I remain
Your most obedient servant,
WM. WHEELER,
President, S. A. C.

CONTENTS.

ANNUAL REPORT.

To His Excellency

KURODA KIYOTAKA,

Minister of the Colonial Department,

Empire of Japan.

Sir :—I have the honor herewith to present to Your Excellency the Second Annual Report of Sapporo Agricultural College, with accompanying papers.

The second year in the life of the College has been fruitful in tokens of a healthy progress and development. Its methods and functions have become more fully determined, and established; its material resources for instruction have been greatly increased; and the scope of its proper work relatively extended. The general results thus far accomplished and provided for, promise fully to justify the aims and hopes with which the College was founded.

Among the additions to the property of the College, and the improvements made thereon during the past year, the following are deemed worthy of mention.

ADDITIONS AND IMPROVEMENTS.

Previous to the organization of the College, the foundation had been laid by the Kwangioka (Bureau

of Production) of the Colonial Department for a Museum of Natural History, representing the various resources and natural features of Hokkaido.

The collections already made, to which the College has contributed largely during the past year through the immediate efforts of Professor Penhallow and a corps of students, have been transferred to its management and use. Thereby, the work of collecting, preparing, and arranging will be greatly facilitated through the direct supervision of the officers of instruction, assisted by the students, who will thus acquire a healthy interest, and much practical knowledge in a most valuable field of study. An annual appropriation of four hundred dollars has been made for carrying on the work, to be administered by the officers having immediate direction thereof.

The cabinets will contain collections representing the natural history of Japan and its productive resources, together with such specimens as may be obtained from abroad by purchase or exchange, and will be used freely for the instruction of students in the universal laws and phenomena of the mineral, vegetable, and animal kingdoms, and their relations to the welfare of man. For this purpose, they will be admirably placed in a large hall, conveniently accessible from the proper lecture rooms, and open to the public at suitable hours.

Provision has been made for the organization of the Military department at the opening of the next academic year.

In order to provide suitable accommodations therefor, as well as for the General Museum and for the instruction of additional classes, plans for a large two-storied building have been prepared, and have been

adopted by the Department. The framing of the building is already begun.

The second story will contain Military Hall measuring eighty-four by forty feet, an Armory twenty-eight by thirteen feet, and a room of the same dimensions for movable gymnastic apparatus. Upon the first floor will be the Cabinet Hall measuring fifty-four by forty feet, the lecture room for agriculture and natural history, and a class room for recitations in English, elementary mathematics and philosophy.

In the College Museum a small work-room will be set apart, to be used in mounting specimens for the cabinets, in making casts of fruits, vegetables etc., and for other detail work pertaining to the proper preparation and classification of specimens. Off the agricultural lecture-room, is a room for the Agricultural Cabinet, to contain models of farm machinery and implements, samples of soils, fertilizers, grains, seeds, and other articles useful for the illustration of lectures.

The interior arrangement of North College has been remodeled and greatly improved. Several useless offices have been dispensed with, and three large and convenient rooms secured in their stead. The second story, which affords the requisite accommodation for the departments of engineering, surveying, drawing and physics, contains a lecture room, drawing office, and a physical and mechanical apparatus room. The first story contains the three recitation rooms required for the Preparatory Department, and also the Reading-room.

The Chemical Laboratory has been completed during the past year, and is admirably adapted to its purpose. The general room for practical instruction

affords accommodation for classes of twenty-four students each.

The Sapporo Plant House, lately erected by the Kwangioka after designs by Mr. Louis Boehmer, under whose direction it was subsequently operated, has been transferred, together with about three acres of land attached, to the management of the College, with instructions directing me to conduct the same in the best manner for the propagation and culture of plants, and for the instruction of the students in practical gardening and horticulture. This will constitute a most indispensable adjunct of the College, and places the whole estate in a complete and favorable condition for imparting thorough training in the practical work of the farm, garden, and hot-house.

Professor Penhallow will manage the plant house and garden, and will superintend the laying out and planting of College Square, in so far as it may be applied to instruction and illustration in arboriculture and landscape gardening. For this work he has prepared plans, the execution of which will begin with the opening of spring.

The completion of the model barn, including the convenient arrangement of many of its details, the erection of a corn barn and sheds, and the execution of various other improvements upon the College farm have been admirably carried out under the management of Professor Brooks, and are described in his report upon the farm, appended hereto.

A list of the new books added to the library, together with a number which have been returned from various places and entered in the catalogue since the publication of the First Annual Report, is appended hereto. Among the additions will be found a list of

thirty-three volumes presented by the Amerian Tract Society. Important additions have been ordered, and are now on the way from America.

A College Reading-room was fitted up in North College last September. The papers and magazines which have thus far appeared on the files have been supplied by the faculty and friends of the College. They comprise about twenty foreign periodicals and one of Japanese publication. An appropriation has been made by the College for increasing the number during the present year.

DEPARTMENTAL INSTRUCTION AND GENERAL REGIMEN.

The interest and activity displayed by the students in the various departments of study have been from the first commendable in the highest degree. The liberal opportunity which the Government has opened to them, conjoined with that receptive turn of mind and the studious habits, which are almost national traits of the better classes of the people, has brought to the new line of study here pursued their best energies.

The methods pursued and the work accomplished in the departments of Chemistry, Botany, and Agriculture are presented in the accompanying reports of Professors Penhallow and Brooks, who have also instructed the sophomore and freshman classes respectively, in English Composition and Elocution.

In the Mathematical and Engineering departments the work done has thus far been chiefly elementary.

The sophomore class have completed their text-book work in geometry, conic sections, and trigonometry, and are now receiving lectures upon the theory and practice of surveying and levelling as applied to the determination of areas, triangulation, harbor surveying, mapping, and the location and construction of roads, railroads, and canals. It has been deemed best to give this instruction in the form of lectures; first, because of the delay in the arrival of a sufficient number of books of any kind, and secondly, because no text books could be procured which treated the desired range of subjects concisely and in accordance with the best modern practice.

The lectures are freely illustrated upon the blackboard, and supplemented by practical examples. Students are required to take full notes, which are critically examined and corrected by the lecturer. Topography and practical field work in the various branches of Surveying will follow during the coming summer and fall.

The freshmen have pursued the study of elementary mathematics as prescribed in the regular course, with very creditable success.

Both classes have received instruction in free-hand drawing, and only await the arrival of drawing instruments, now over-due, from America, to engage in geometrical drawing and mapping.

In all stages of instruction in both elementary and applied mathematics,—as in all departments of learning involving the *thinking* faculties,—general principles must be exalted above individual facts. The interest and native powers of the student are enlisted and strengthened by exercises in original demonstration, solution, and application. No student should

ever be asked to "*repeat* the rule;" or "what is *the rule*;" etc. *A* rule or process may be required of him; but too great reverence for, or dependence upon, the one given by an author should be just so far discouraged as the powers of the pupil will enable him to formulate one of his own. No pupil that has learned to read is old enough to learn properly the facts of any branch of deductive science, until he is capable of comprehending the principles upon which our knowledge of it is founded. The habits which we acquire in getting knowledge are often quite as important as the knowledge itself; and no habit is quite so valuable to a scholar as that of understanding what he assumes to know.

The regular course of instruction in the College has been modified by the exclusion of Chinese literature, to take effect after the present academic year. The time devoted to the Japanese and Chinese classics in the Preparatory Department has been proportionally increased, and the requirements for admission to the College advanced accordingly.

A knowledge of the elements of algebra has also been made a requisite for admission.

These changes seemed almost imperative in view of the wide range of more advanced subjects to be taken up in the College course, and in consideration of the fact that under existing arrangements there is no provision by which students may further qualify themselves for special work in advanced positions, after the completion of the regular course, save by personal effort alone.

I would commend to Your Excellency's consideration the establishment of post-graduate courses of study in a few of the leading departments, to each one of

which the most distinguished student in such department of study may be appointed for one or two years after graduation; there to receive advanced instruction, and to assist the head of such department in practical work and in the elementary instruction of the lower classes. Such students would thus acquire an excellent special training, and from them the future professors of the College should be selected as rapidly as the services of foreign employes can be dispensed with.

During the summer vacation the students of the present Sophomore class were organized in three parties to assist in various practical works under the direction of members of the faculty, — an excellent method of uniting thorough recreation with instruction from the best of books — Nature, under the best of teachers — Experience.

Messrs. Ideta, Oshima, I. Sato, S. Sato, Tanouchi and Uchida accompanied Professor Penhallow upon a scientific expedition up the Ishikari river and some of its unexplored tributaries, undertaken for the purposes of exploration and the collection of specimens.

Messrs. Ito, T. Ono, Watase, Yamada, Yanagimoto and Yasuda devoted themselves to the collection of plants and minerals in the vicinity of Sapporo, and assisted at the farm under Professor Brooks. They afterward accompanied him upon on excursion for collections and for inspection, including in its circuit Mooran, Oshamanbe, Iwanai — where the coal mines were examined —, Yoichi and Otaru.

The other members of the class, Messrs. Arakawa, Kuroiwa, Nakashima, and K. Ono accompanied President Wheeler to assist in the location of a new highway through the Kuromatsunai district, from

Volcano Bay to Sutsu on the west coast, and also visited the mines at Iwanai on their return.

In addition to their regular departmental instruction, the members of the faculty have devoted a part of their time to teaching the advanced class in the Preparatory Department. This service, although nominally voluntary, was rendered almost imperative by the want of a regular foreign master, — a want, however, which is about to be removed by the act of Your Excellency approving the employment of a competent American. The resignation of Instructor Hori of the Preparatory Department, September last, also increased the necessity for extraneous assistance. Your Excellency's confirmation of my proposition for the employment of a Professor of Physiology and Comparative Anatomy will supply a much needed officer. The gradual development of the College, the admission of new classes and their advancement to higher stages of learning and work, will demand the constant application of teachers of special qualifications in the several departments.

In view of the fact that this College is subject to no regular inspections by public examining boards, and that there are but few representatives of the people of Japan who are in a position to give any information respecting the general scope of its works or the standard of scholarship maintained, it has been thought wise to publish with the Annual Report, abstracts of the semi-annual examination exercises together with the relative rank and scholarship attained by the students. A permanent record will thus be kept where it will be readily accessible to all who may desire it.

As an incentive to severe mental effort on the part

of students who are already studious almost to a fault, its importance is not great. On the contrary, it has seemed necessary to urge upon them hospitable entertainment of the fact that the basis of executive power, of triumphant action, of buoyant impellent power, is largely physical; and that the unflinching labor which almost automatically prosecutes the steadfast purposes of the will is possible only with an organism of healthful functions. "The acquirements of science may be termed the armor of the mind; but that armor would be worse than useless, that cost us all we had and left us nothing to defend."

The climate of Hokkaido is undoubtedly very salutary. Students have almost invariably declared their enjoyment of improved health since becoming residents of Sapporo. Whether this may be due in part to their unanimous and voluntary pledge of total abstinence from the use of alcoholic beverages and tobacco in any form, is a question in which we may wisely disclaim for the climate, the whole virtue.

At the close of the first academic year of the College, July 4th. last, a public exhibition was held, which consisted of the following exercises by members of the pioneer class :—

Salutation, in Japanese and English, and English Oration: "Is Labor a Blessing or a Curse?" S. Arakawa.

English Oration, on "The Importance of Agriculture." N. Yasuda.

Select Declamation, from "Mazeppa," Y. Kuroiwa.

English Oration: "A strong will and a strong mind." M. Oshima.

English Oration: "Individual Enterprise the Source of National Properity." S. Sato.

Select Declamation: "On American Affairs." S.

Tanouchi.

English Oration, on "Health essential to Success." T. Watase.

Japanese Oration: "The Importance of Agriculture." H. Ito.

His Honor, Director Dzushio then addressed the students, after which the government Prizes for the preceding year were awareded.

PROGRESSIVE AND NON-PROGRESSIVE EDUCATION IN JAPAN.

It has been remarked by many, both natives and foreigners, whose opportunities for observation have covered a much longer period than do my own, that Japanese students have shown greater aptitude for learning than is manifested by those of American and European institutions; but that subsequently, in the active walks of life, they have almost invariably fallen behind the heirs of that practical, progressive, self-asserting spirit which has been the impulse and the fruit of western civilization.

This is said as well, perhaps chiefly, of those sent to America, who afterwards returned to serve their country; and hence cannot be attributed to the relative inefficiency of institutions founded at home for the promotion of foreign learning. Single-handed against a hundred-fold their number, they have frequently carried off honors of the highest rank at foreign institutions.

We need not look far to discern some of the causes which have produced this anomaly. Evidently the

principal are these: first, inherited qualities of mind accruing from peculiar systems of learning and conditions of society which have existed for ages; and secondly, influence of environment upon powers of application and habits of thought.

A profound regard for learning during many centuries had left unlearned the most potent laws and principles of nature, of society, of human capacity. Utter dependence, even to veneration, upon the ancient classics of equally inert China as the fount of all knowledge, gave no impulse to rise above its source. The time necessary to master the formidable array of characters, which were the sole weapons of intellectual warfare, left few men enough of strength or years to make higher conquests. While a few aesthetic arts were carried to a wonderful degree of perfection, the practical resources of design and invention were strangely neglected. The shifting wealth and power of barons and commanders confirmed the poverty and helplessness of the masses. Multiple centers of dominion necessarily co-existed with the usurpation of governmental authority, rendering the state impotent to promote the general welfare. The maintenance of nearly one-half the people,— the ablest of the nation,— in unproductive plenty, subjected the other half to hardship and poverty.

The ancient learning of Japan, vast but inert, was such as to cultivate the memory to the highest degree and to neglect the powers of thought. Her art and industries, the same for ages, were productive of a remarkable degree of imitative power and hand skill, at the expense of the faculty for invention and original design. The helpless masses in yielding their substance to the powerful, learned to be con-

tent with a mere life-sustaining pittance. The powerful, whose strength was in the subjection of the weak, planted deep the root of helplessness in themselves.

Now, fortunately, the entire regime is changed; but the fruits of the past cannot be eradicated at once. Traits which have been ages in the making must need generations in the breaking.

Memory is imitative. It is the agent of all primary instruction, enabling the learner to follow readily where others have led. Original thought is progressive, and makes the possessor a leader where there be few can even follow. The thinker is a poor copyist, though possesed of creative and life-giving power. The imitator is incapable of surpassing his model just in proportion to the singleness and perfection of his power to equal it. The one makes leaders; the other, only followers.

An excellent memory will enable a student to outshine one who must stamp every fact and principle with the seal of perfect comprehension ere it can claim a place in the archives of the mind, so long as the work involved consists in taking in the elements of truth as commonly taught. But when the exigencies of life call for their use, not in the few elemental forms in which they were stored away, but by combination and permutation to be applied to an infinity of cases, not one of which, perhaps, can the best memorizer or imitator recall or identify, then are their powers displayed in a widely different light.

So the habit and faculty of adapting and applying in life even the simple facts which come to one who never saw the interior of college walls, often enable him to outstrip others who have received the best instruction the institutions of the world affords; and he

is accredited with being "self-made", when in truth he is indebted, beyond the average of his fellows, to the Creater of all men.

Now in view of the peculiar traits which have descended to the present generation, it seems clear that if those systems of scientific and practical instruction which have been so widely adopted in the higher institutions of the western world rest upon true principles, still more are they meet for the needs of Japan.

The deductions of science are both logical and practical; and the value of its study as a mental discipline, far from being impaired when allied with processes for deducing its applications, should be increased. The logical connection between facts and principles, — the subordinate and paramount in learning, — ought always to be clearly maintained; and their application to the general concerns of life serves not only to render them of double and ten-fold the service to man, but fixes them more securely in the mind. To know *how* is to be a peer in a single art. To know *wherefore* is to be a master in all its own and dependent possibilities. Knowledge without thought is impotent to go beyond itself; but thought and knowledge have unlimited resources.

An old writer observes that " we fatten a sheep with grass, not in order to obtain a crop of hay from his back, but in the hope that he will feed us with mutton and clothe us with wool". Paraphrasing the comment of another, we may apply this to the feeding of the mind: we teach a young man mathematics, logic, and natural science, not that he may simply take his equations and diagrams into a government office, or carry his borrowed propositions and demonstrations into the national council chamber, or that he shall

hang his formulas and classifications high above the door of nature's laboratory; but that he may bring into all these places a mind so well stored with the sound principles of truth and reason as to be able to distinguish between fact and appearance, argument and sophism; to mould the facts of science to the intelligent purposes of his will in the ever changing problems and circumstances of life; to make the end to be accomplished, the key to its accomplishment, even as the simple yet wonderful effects in nature shadow forth their potent cause.

GENERAL OBSERVATIONS.

In the midst of the pressing duties which have regularly fallen to the officers of instruction, by virtue of their limited number, they have given freely of their time and strength to the promotion of any and all objects and interests of the Colonial Department to which their consideration has been called; and such calls have not been infrequent.

Professor Brooks, while discharging the combined functions of teacher and director of the College farm, has planned and superintended the execution of various permanent improvements, and the erection of buildings upon the farm. He has prepared for the Department a report upon the future maintenance of the farm when the limitation of special government aid to the present organization for colonization shall have expired, (December 31st. 1880), setting forth the measures best calculated to render it self-sustaining as an educational institution, and a model of practical economy. He has also undertaken a most highly commendable work in giving to the various employes

upon the farm and such others as desire to avail themselves, practical talks and lectures during several evenings of each week upon farm management, the care and training of animals, and general agriculture.

Special reports upon the raising of seeds for general distribution throughout Hokkaido, and upon the castration of native stallions have been prepared by him for the Department.

Professor Penhallow has renderd much valuable assistance, and conducted many skillful investigations in behalf of the Department. He has made complete analyses of sugar beets grown in various localities, of various metallic ores, minerals, and soils, and an experimental determination of the production of tar from wood by distillation. Reports upon the value of the beet root for the production of sugar in Hokkaido, as partially determined by the experiments made during the past year, and upon the scientific expedition made by him during the summer vacation have been prepared at the special request of the authorities, abstracts and digests of which he has presented for transmission herewith. He has also made plans for the erection of a coking-furnace, and given practical directions on the manufacture of soap, candles, matches, leather, for the refining of fish oil, and other technical industries, together with drawings of various contrivances requisite for carrying on the work covered by his instructions. Perhaps no part of his work outside the lecture room has quite equalled in importance that devoted to the collection and preparation of specimens for the Museum of Natural History, in which, also, the students of the sophomore class have assisted with great zeal. In addition to the regular duties of his office, various services have been

rendered by the President. Meteorological observations have been continued during the year, upon which an annual report is transmitted herewith. Three special students have been instructed in the methods of observing and making the required computations. One of these has since received an appointment to the Hakodate meteorological station, and another to a station about to be established at Nemuro. Plans for the new military hall and Museum building, designs and drawings of various forms of machinery, and plans and estimates procured from America for a complete flouring mill, have been presented to the Department.

Various services as consulting engineer upon the principal works of the Department have been rendered, which, in the absence of a general report thereon, may be briefly stated in this connection. In May and June last a reconnoissance for a new highway from Volcano Bay to the western coast was made, and the road was located during the summer vacation. Plans and profiles have since been made, and the construction ordered by the Department. An inspection was also made of upwards of one hundred and fifty miles of mountainous road from Ono to Yesashi, and thence via Fukiyama (Matsmai) and Kikonai to Hakodate. At Hakodate several sources of proposed water supply were examined at the request of the local government, and plans and estimates based upon systematic surveys of the most promising schemes were recommended, in order that the question might be definitely settled. The wharf and break-water at Mori was carefully inspected. It had evidently yielded slightly under violent action of the sea, and measures for strengthening it, and for substituting stone for wood in its construction, were proposed.

The partial destruction by flood, on the 30th of April last, of the combined arch and truss bridge over the Toyohira at Sapporo, involved a work of peculiar difficulty in its reconstruction, owing to the lack of suitable conveniences therefor. By special instructions from Your Excellency the general treatment of the matter was placed in my hands. An entire change in the disposition of the pier, the short span, and embankment walls was found necessary. The pier was replaced by an abutment,—the short trusses being entirely removed,—the foundation placed nine feet lower, and the wide span increased seventeen feet by moving the entire superstructure so as to conform to the new position of the abutment, thus making the clear water-way one-hundred and ninety-four feet. The work was completed December 31st., and much credit is due to Messrs. Iwafuji, Adachi, and Coka for their able services thereon. The lesson of its failure, though costly, was perhaps of commensurate value.

My return from Volcano Bay, June last, afforded an opportunity to make a partial reconnoissance for a railroad route from Mororan to Sapporo, via the valleys of the Osharabetsu and Toyohira rivers and an intervening mountain pass. While no insurmountable obstacles were discovered, want of time made the examination insufficient to demonstrate the feasibility of the route. It possesses unequalled merits in point of directness, and character of farming and timber lands adjoining it.

During the month of January last, several interviews were held with a representative of the Department from Nanaye, for the consideration of means for promoting the dissemination of practical knowledge,

pertaining especially to Agriculture, among the people of Hokkaido. Organizations devoted to similar ends in America and Europe, and the adaptation of the same and other means to like objects in Hokkaido were considered ; and in view of the peculiar importance of the subject in this relation, I beg leave to refer your excellency to the following brief abstract of a resume prepared by special request :

"The first and greatest obstacle to be encountered in an attempt to disseminate even practical knowledge among the farmers and people of Hokkaido is their general inability to read the written language of the Empire."

" A limited amount of progress might reasonably be expected, if they were supplied with improved implements and a few domestic animals upon easy terms, and provided with grass, corn, and other seeds ; and if they should follow as far as practicable the methods of culture and management exemplified upon the College and other government farms. But so great would be the departure from the almost historic regime of the existing agriculture of Japan, that it would be difficult to induce farmers to accept these privileges, unless their interest could be fully enlisted by their being made to understand, or to have faith, that their present condition and that of the country could be made better through such radical innovations."

"In the absence of any practical illustrations evidencing this fact in all the history of Japanese farming, such a conviction can be impressed upon the unread only by direct oral instruction.. . . . . .Hence the plan for sending out practical teachers, lecturers, or agricultural and industrial exhorters seems to be a most commendable one — an essential requisite to the

purpose in view; and I would add that to furnish capable men for missions of this nature should be considered one of the first objects of the Agricultural College".

"The people should be directed in the methods of cultivating the various crops introduced; in the use, care, and training of the common domestic animals; in the importance of better dwellings for themselves, and the economy of shelter for live-stock and hay; in the preparation of food from their new resources; and in the raising and adaptation of surplus products for the best markets. The government should also use every reasonable means to create markets for these products, until the public mind and taste shall become adapted thereto, by making known their merits and applications as food, for manufactures, and so forth. It could make the object sought of direct advantage to the producer, as well as consumer, by agreeing at the outset to buy and sell for a limited period, upon terms favorable to both parties. In view of the superior facilities commanded by the Department, and of the..... paternal relations which the government has always borne toward the people, — as in the management of the silk, tea and rice industries of Japan, — I believe it could be generally carried out without pecuniary loss."

" Another commendable provision to stimulate improvements, would be one similar to that adopted to encourage forestry in American states, as for instance: the offer of special premiums for the best field crops of various kinds; for improved domestic animals; fixed bounties to be paid *pro rata* for lands devoted to foreign grasses, indian corn, wheat, and other specified crops; for the reclamation of land, improved houses,

and farm buildings."

"In thickly settled communities, in the vicinity of the government farms especially, agricultural exhibitions could be made of interest and advantage. The people should be shown the various features of these farms adapted for imitation by them. They should be made familiar with the various objects to be attained, and the methods pursued for their attainment."

"The importance of working among and for the people cannot be over-estimated in seeking the nation's welfare. No reasonable resort should be left untried to make them feel that the government is deeply concerned in their own behalf; that their interests are strictly mutual; that the true national wealth and prosperity is only the reflection of their own. Certainly, the government is striving earnestly in many ways to promote its own interests and well-being, hoping thereby to alleviate the condition of the masses. But the importance of the masses as an agency to the accomplishment of this grand purpose cannot be disregarded. The inviolable law of antecedent and consequent, of cause and effect, cannot be reversed."

"The nation can have few resources except through the people. In every free country, the people are first, the government last in the order of dependence. The government must serve them always if it would serve itself best. If the people shall realize this, and the state shape its policies for progress without conflict therewith, it will promote the happiness and non-dependence of the one no less than the dignity and glory of the other."

CONCLUSION.

Among the foreign visitors at Sapporo and the Col-

lege during the past year were Mr. Chas. Mares, of the British Museum; United States Consular Agent, Rev. Mr. M. C. Harris; H. B. M's. Consul, Mr. Richard Eusden and Mrs. Eusden; Professors Milne and Perry of the Imperial Engineering College; and H. B. M's Envoy Extraordinary and Minister Plenipotentiary, Sir Harry S. Parkes, Lady Parkes, and suite.

The termination of President W. S. Clark's brief but effective mission to organize the first Agricultural College in the Orient, and his consequent departure, April 16th. last, to resume the management of its American prototype, was almost the sole event of the year in the history of the College which we have cause to regret. To the benefits derived from his learning, experience and energy the Colonial Department will ever remain indebted; and the memory of his inspiring example will be a spring of earnest endeavor in the hearts of the students and officers with whom he came in contact during his stay in Japan.

In submitting to Your Excellency the report of the work and progress of another year, I beg leave to acknowledge the courtesy which has invariably been shown me, and the authority and trust which I have had the pleasure to labor under and the honor to receive throughout my various duties.

I have the honor to remain, Sir,
Very Respectfully
Your Obedient Servant,
Wm. WHEELER
President.

Sapporo, Japan
March 18th. 1878.

REPORT

ON THE

CHEMICAL DEPARTMENT.

PROF. D. P. PENHALLOW, B. S.

PRESIDENT Wm. Wheeler.

Sir:

I have the honor to submit the following report;

During the past year, the Chemical Department has been placed in very good condition for the accomplishment of its legitimate work by the completion of the laboratory, and its equipment with apparatus, the larger part of which was received from America last spring.

The mineralogical cabinet is already full. The majority of the specimens are from Europe, are of convenient size for lecture room purposes, and represent various geological formations as well as minerals of special economical and scientific value. There have also been collected, during the past summer, quite a number of specimens illustrating the geological and mineralogical character of the island of Yesso, forming the nucleus of a larger collection.

The chemical cabinet contains a good collection of various elements and their salts used for illustration in the lecture room; while for the same purpose, the various groups and compounds of organic chemistry are represented by a good collection of representative compounds.

In connection with these, it is designed to form a collection of those substances which are important in industrial arts from a chemical standpoint, and the nucleus is already formed.

INSTRUCTION.

The course of instruction as pursued during the past year has involved the use of Well's Chemistry as a text book, with which was associated Fowne's Chemistry as a book of reference.

An aquaintance with the principles of Chemical Physics, and the characters and properties of the various elements serves as an introduction to practical chemistry, which commences the second term of the Freshman year, and extends over a period of one year. During the theoretical course, the various physical laws, as well as the chemical behavior of elements, are explained by experiments and lectures.

The practical course is designed to render the students familiar with the methods of analysis and the composition of minerals, soils and fertilizers. They therefore receive instruction in both the blowpipe and humid methods, and, at the end of the course, are introduced to general methods of assaying and quantitative analysis; the practical work being accompanied by lectures, the aim of which is not only to give the students familiarity with the methods involved, but to bring before their minds, and interest them in, the practical operation of those principles, when applied to industrial arts.

The students are required to take notes of, and formulate all reactions in detail, afterwards explain them in the lecture room, and submit their note books for final correction.

Organic Chemistry has been assigned a place at the end of the practical course, since it is desirable for the students to become as familiar as possible with the nature of chemical reactions, before they attempt to dis-

cuss the complex reactions and compounds of organic chemistry.

It gives me pleasure to note that the students have uniformly manifested a praiseworthy zeal in their work, and have also been ready to assist in any work connected with the department.

In addition to the regular duties of the department, attention has been frequently given to various subjects connected with industrial operations of various kinds.

The production of wood tar, the coking of coal, the manufacture of soap, candles and matches, and analyses of ores as well as refining fish oil, and the consideration of questions relating to leather manufacture, have demanded more or less attention.

An analysis of the soil of Sapporo is now in progress, and soils collected from various sections of the Ishicari valley, as well as from adjacent mountain districts and tributary valleys, during the past summer, will be subjected to analysis as fast as other duties permit.

BEET SUGAR.

During the early fall, analyses of sugar beets were made, to determine the amount of sugar, and the possibility of profitable sugar manufacture in Hokkaido. A few words in relation to the same may not be out of place here.

The roots brought to the college laboratory for analysis were from three different parts of the island. The first were from the college farm at Sapporo, and were gathered on the twenty-first of September, when from their appearance they were considered mature.

The treatment and growth of the beets will be found treated of in Prof. Brooks' report.

Roots, thought to be of the average size, were selected from various parts of the field, and it was found that their weight varied from one pound ten ounces to three pounds four and one-half ounces, the tops having been cut off as far as the leaf scars extended. Their average weight was thus $2^{lb.}$ $7^{oz.}$

At the time of harvest, it was found that some of the roots reached the great weight of ten pounds, while the average of each was estimated at four pounds.

The second were obtained from Otaru, grown on the farm of His Excellency Enomoto Buyo, by whom the seed was sent from Russia. Unfortunately the kind of beet was uuknown.

The third were sent from various farms in the vicinity of Mororan, but, as they had been some days in transit, they arrived in a condition that rendered an analysis worthless.

The method of analysis was the same in each case. The carefully cleaned and weighed roots were reduced to a fine pulp on a coarse grater, and the juice extracted by the action of a small screw press. The juice was at once defecated by basic acetate of lead and filtered. By digestion with sulphuric acid for eight or ten hours, the cane sugar was changed into inverted sugar, the free acid neutralized by carbonate of soda, and the amount of grape sugar present was then determined by Fehling's copper solution. The complete inversion of the cane sugar was insured by trial tests.

The subjoined list will exhibit the results obtained.

In 100 Parts of Juice.

White Imperial (?)		Russian Seed.	
Sugar.	5.952	Sugar.	8.928
Sugar.	5.952	Sugar.	8.928
Moisture @ 100° C.	91.395	Moisture @ 100° C.	85.11
Specific gravity of juice. 1.035 @ 62° F.		Sp. gr. 1.055 @ 62° F. Average weight 1lb. 5oz.	

It is thus seen that the roots from Otaru yield a much larger percentage of sugar with less water than those raised at Sapporo. As the White Imperial usually yields more than double the amount of sugar found here, the markedly low percentage obtained would indicate some special causes, which may be stated as follows;—

The seeds obtained from California were supposed to be good, and planted with that belief. At the time of harvest, however, it was very evident the seed had previously been badly mixed.

Excessive development of the root is not well adapted to the formation of a large percentage of sugar. It is necessary that the growth should be healthy, resulting in a root of firm texture, and of moderate size, for the best results.

The roots raised here, however, not only had a large percentage of water and reached great size, but often exhibited want of compactness, in some cases being almost hollow.

While we should undoubtedly look to the soil as the partial cause of such results, it seems also highly probable that the character of the climate exerts a powerful influence. This is well seen in the very vigorous growth, which nearly all kinds of vegetation make during the months of July and August, previous

to which time all growth progresses slowly.

The growth of all vegetation about Sapporo continues late in the season, owing to the fact that frosts do not appear until the middle or last of October. It is therefore quite possible that the determinations were made before the sugar was thoroughly perfected.

The analysis of the soil of Sapporo is not sufficiently complete at present for statement; and while we can safely say that its mechanical condition is admirably adapted to the growth of roots, its chemical composition must be well known before a proper expression of opinion can be given as to its natural adaptability to the growth of sugar beets and the formation of sugar.

Beets should yield ten per cent of sugar to ensure profit in their working. It may be very truly urged that the merely nominal taxes and the low price of both fuel and labor in Hokkaido are strong arguments in favor of the industry, rendering profits possible from a poorer quality beet than could be worked elsewhere. On the other hand, the increased expenditure requisite to extract the same amount of sugar from an increased bulk of roots causes profit or the advantages of cheap-labor &c. to disappear rapidly.

While the above results are not sufficiently definite to allow a final decision upon the practicability of the industry, they demonstrate the need of further experiments with *good* seed and upon a more extended plan. Seeds of the best varieties have already been ordered from Germany, and another year will be devoted to the subject, when it is fully expected that, with more favorable conditions, more careful methods of cultivation, and observance of effect of climate, soil, and time of complete ripening, better if not favorable results

will be obtained.

The annexed analyses seem to be of sufficient interest to be placed on record.

The analysis of ore is of that taken from a newly discovered vein near Yuichi, reported to be of considerable size. Samples were brought to Sapporo for analysis the latter part of September. The samples presented were taken from two parts of the vein at a considerable distance apart, and on inspection the one proved to be compact with little or no crystalline structure; galena and pyrites evident; and earthy matter inconspicuous. The other was finely granular; texture rather loose; earthy matter abundant; galena evident; pyrites apparent.

As the disposition of the ore would warrant separate working of the two grades, and their composition might render the same advisable, separate determinations were made of the two samples.

The following gives the combined results as the composition of the ore for the whole deposit.

Galena. *(Yuichi)*

In 100 Parts.	
Lead.	29.252
Copper.	6.049
Silver.	0.045
Iron and volatile matter With gangue.	64.653
	99.999

Determinations of alcohol in various kinds of Japanese "Saké" have recently been made with the following results.

The samples were taken directly from the stores.

Name.	Specific gravity at 60° Fah.		Corresponding per cent of alcohol
	Original Liquor.	Distilled.	
Echigo.	0.9900	0.9770	15.00
Mirin.	1.0650	0.9800	13.00
Osaka. No. 1	0.9900	0.9800	13.00
Osaka. No. 2	0.9925	0.9770	15.00
Oyama.	0.9900	0.9750	17.00
Sapporo.	0.9875	0.9800	13.00
Shiroisake.	0.9900	0.9800	13.00

With the exception of the last, all are of an amber color and seem to contain more or less sugar, particularly in the case of Mirin, to which its high specific gravity is due.

Shiroisake being made by incorporating cracked rice with ordinary saké, derives its name from the consequent white color. The percentage of alcohol in this must necessarily be variable since fermentention is constant, owing to the presence of the rice.

A light, porous pumice stone, much used at Sapporo for building and other purposes, has been subjected to a quantitative analysis with the results given below.

The basic constituents and silica are given in order of predominance.

Sapporo Pumice Stone.

Specific gravity.	1.1726
Absorptive power, percentage weight.	18.82
Silica.	
Alumina.	
Iron.	
Magnesia.	

The stone is essentially a silicate of alumina and

magnesia with considerable iron and what appears to be finely powdered quartz. Exposed to the action of a brisk wood fire, it fuses somewhat, forming an imperfect glass.

Clay from the Ishicari river near the mouth of the Toyohira, and also from Nanai, has been subjected to analysis and found to consist chiefly of silicate of Alumina with iron, small amount of magnesia and very small quantity of lime. It seems to need nothing but a slight addition of sand to adapt it to the manufacture of good bricks, and that is certainly no obstacle in the way of its use.

REPORT

ON THE

BOTANIC DEPARTMENT.

PROF. D. P. PENHALLOW, B. S.

PRESIDENT Wm. Wheeler.

Sir:

I respectfully submit the following report:

The work in the Botanical and Horticultural Department during the past year has been very largely in the line of theoretical instruction. With the close of the summer term the present Sophomores completed their course in botany, having pursued the same somewhat in advance of its regular position in the curriculum, their instruction being received chiefly from President W. S. Clark.

According to the plan adopted, instruction is given by lectures upon the subjects of Structural and Physiological Botany, with practical work in the analysis of plants. The students are also expected to collect and properly preserve two hundred species of plants, excursions for that purpose being encouraged as much as consistent with other duties.

For lecture room purposes diagrams on cloth rolls are used. About three hundred figures have already been finely executed in colors by Mr. Ichinose, and others are in course of preparation by the students.

In addition to their collections of plants, the students have been encouraged, and have manifested great interest, in the collection of all objects of Natural History. At the opening of the last spring, the present Sophomores were divided into three collecting corps, to each of which was assigned the collection of minerals or some particular classes of Zoological specimens.

A prize was offered for the best collection in each department, viz;

Plants,.....	Henfrey's Botany,
Minerals,.....	Dana's Geology,
Insects, ...	Packard's Insects,
Animals exclusive of insects.....	Milne Edward's Zoology.

All specimens were to be collected in duplicate, one being reserved by the collector, the other donated to the College. In this way the students become directly interested in building up a museum, each one receiving due credit for his specimens; but since only the best of all is to be actually placed on exhibition, a healthy rivalry is thus fostered among the collectors. The work thus commenced was carried on through the season with enthusiasm and good results. Each student collected several hundreds of species of plants in quadruplicate, while good collections of birds and insects have also been made.

Five of the students, who have manifested particular interest in ornithology, received instruction in Bussankiyoku from an officer of the Kwangioka, and are now able to prepare specimens in a very creditable manner.

The interests of the department have been further advanced by the accession of a small plant house and about two acres of land immediately surrounding it. This latter will be devoted to the propagation and culture of such vines and fruit trees, as well as flowers, as are necessary for purposes of instruction.

The larger lot of about ten acres, in which the college bulldings are located, will be devoted to an arboretum, to contain the various trees and shrubs of Hokkaido.

It also seems desirable that attention should be given to the introduction into cultivation of those trees and fruits which already have been, or under suitable cultivation can be made to have any particular value. The natural fruits of Hokkaido are few, and should be brought into cultivation if likely to develop into any thing valuable. The Kokuwa, perhaps the most noticeable of the wild fruits, possesses a very good natural flower, is a large juicy berry, and seems very susceptible of improvement. Cuttings of the vine have already been started in the plant house, and will be cultivated in a manner similar to grapes.

During the summer vacation an expedition was organized under the auspices of the department, for purposes of exploration, collection and experience for the students. As finally organized, the expedition proceeded to explore the rivers and mountain region northeast from Sapporo, making the Ishicari river the base of operations. A summary of the notes taken accompanies this report.

The specimens collected are now in process of preparation for cabinet use, and are intended to form the basis of a general museum.

A condensed list of specimens collected during the summer will be found appended.

In conclusion, it is a pleasure to acknowledge the assistance which many of the students have rendered in preparing and arranging specimens, and the earnestness with which they have prosecuted all tasks.

SPECIMENS COLLECTED DURING THE SUMMER OF 1876.

Birds		50 ,
Calcite	from	Ashibet river,
,,	,,	Unosawa,
Clay shale	,,	Ashibets river,
,,	,,	Ishicari ,, ,
,, Shale	,,	Sorachi ,, ,
Coal	,,	Ashibets ,, ,
,,	,,	Ikushibets ,, ,
,,	,,	Poronai Mines,
,,	,,	Sorachi ,, ,
Disintegrating Clay Shale		Ikushibets river,
Fossil Mollusks	from	,, ,, ,
,, ,,	,,	Sorachi ,, ,
,, peat	,,	Ikushibets ,, ,
,, plants	,,	Ashibets ,, ,
,, ,,	,,	Poronai Coal Mines,
,, ,,	,,	Sorachi river,
Galena	from	Yuichi,
Gold-bearing Clay from Unosawa,		
Insects		200 ,
Iron ore	from	Ishicari,
,, ,,	,,	Sapporo,
,, Sand	,,	Toyohira river,
Lichens	,,	Ashibets ,, ,
Lime	,,	Hakodate,
,, balls	,,	Ikushibets river,
Limestone	,,	Unosawa,
Petrified wood	,,	Sorachi river,
Plants		400 ,
Sandstone	from	Ashibets river,

Sandstone	from	Ikushibets river,
,,	,,	Poranai Coal Mines,
Skeleton of Horse,		
Soil	from	Headwaters of Ashibets river,
,,	,,	Bibai river 6 miles from mouth,
,,	,,	Headwaters of Ikushibets river,
,,	,,	Ikushibetsbuto,
,,	,,	Poronaibuto,
,,	,,	Poronai Coal Mines,
,,	,,	Sapporo,
,,	,,	Sorachi R. 15 miles from mouth,
,,	,,	Urashinai, Ishcari river,
Viper,		
Woods native		23.

In addition to which are several specimens of snakes and fish, and anatomical specimens.

REPORT

ON THE

AGRICULTURAL DEPARTMENT.

PROF. Wm. P. BROOKS, B. S.

PRESIDENT Wm. Wheeler.

Sir:

It seems befitting that, in this the first annual report published since my active connection with the college as professor of agriculture, I should present a brief account of the methods of instruction pursued and proposed, in order that all interested may be able to form some idea as to the scope and value of the course of study and training offered. The education in this department is both theoretical and practical, and is intended to fit those who faithfully complete the course to successfully manage the business of farming in all its branches according to the most advanced scientific and economic methods. It is also the intention to teach them how to conduct accurate agricultural experiments for the solution of questions requiring the application of scientific knowledge.

The theoretical instruction is given entirely by lectures, upon which the students are required to take notes which they afterwards copy upon loose sheets of paper. These papers are critically examined, and such corrections made as are needed both as to matter and style, after which they are neatly copied into convenient record books furnished for the purpose, in which shape the lectures are preserved in a good form for future reference and use. The students are carefully questioned at each exercise upon the subjects discussed in the last; and the greatest pains is taken to make certain that all thoroughly understand every topic treated

of. Questions of practical nature are frequently introduced, which require for solution an application of the principles under consideration. By means of this careful questioning and frequent reviews, the subject-matter passed over becomes very firmly fixed in the minds of all. In all my instruction, I am particular to give the reasons for every statement made, and I try to lead the students in their recitations to state these reasons plainly and forcibly, believing it to be of the utmost importance to train them to think logically and clearly. Wherever it is possible for them to deduce the reasons for any thing stated from principles already taught them, I endeavor to lead them to do so, aiming thus, in every possible way, to teach them to think consecutively and with mathematical precision and method. The faculty of putting observed facts and known principles together, and deducing therefrom the legitimate conclusions which a trained and logical mind is capable of forming is, in my opinion, worth much more to a man than an encyclopedic knowledge of dry facts without this power, which is, indeed, the animating essence which alone is capable of making a man's knowledge of use either to himself or his fellows.

The course of lectures given is systematically arranged according to the order which seems to me most natural, and embraces a very wide range of topics. To mention them all would occupy too much space, neither would it serve any good purpose, and therefore I will enumerate only a few of the most important. These are as follows:—Importance of Agriculture as an Occupation and its Influence on National Prosperity; Branches of Knowledge Essential to the Farmer, showing the importance of each;

Geologic Changes which have been Chiefly Instrumental in converting the Crust of the Earth into Soil; Influence of Mechanical, Chemical and Physical Agencies, such as Moving Water and Ice, Oxygen, Carbonic Acid, Heat and Frost in the conversion of Rocks into Soils; Influence of Animal and Vegetable Life on the Inorganic Elements of our Earth; Different Classes of Soil and their Relative Value; Mechanical and Physical Faults and the Remedies for them; Implements used in the Pulverization and Tillage of Soils; The Atmosphere and its Relations to Plant Growth; The Plant—its changes and improvement by cultivation; Diseases of Plants—their prevention and cure; Adaptation of Plants to Soils; Manures, both Organic and Inorganic—their adaption to different soils and crops; Renovation of Barren Soils; Crop Rotation; Rules for Farm Management; General Farming—including rules for the selection of a farm, based upon the natural characteristics of a country, a consideration of the necessary farm buildings and the principles which should guide in their location and construction, and practical directions as to the proper work of each season and the best methods of doing it; Farm Roads and Fences; Farm Accounts; Special Farming, with specific and minute directions for the culture of the various farm crops; Stock Farming, under which head are considered the principles of breeding all kinds of domestic animals and the adaptation of the different breeds to different uses; Forestry—including a consideration of the influence of forests upon the climate of a country and of the value of the different kinds of trees for the various economic purposes, the best methods of planting and caring for woodlands and preserving them where they are already

present.

In addition to lectures, it is proposed to introduce extempore debates upon agricultural subjects, near the close of the college course. This exercise it is believed will prove very beneficial, both as a review of the subjects treated of in the earlier portions of the course, and as an effectual training in habits of logical thinking and talking.

The aim of all instruction in this department, while it is specially applied to the circumstances of this province, is to impart a knowledge of correct principles, which, well understood, will enable a man to succeed under whatever conditions he may be placed. Knowing these principles a man can vary his practice as the occasion may require, and a little experience will make success certain in all cases.

Special training will be given in experimental farming during portions of the Sophomore and Junior years. To this end questions will be proposed to each member of the class at the beginning of the second term of the sophomore year, which require in their solution the exercise of painstaking exactness and more or less scientific knowledge. Each student will be required to write out a careful account of an experiment which he thinks will answer the question. This he will submit to me for criticism and revision; in which criticism no pains will be spared to point out his errors, if there should be any, and to show him clearly wherein and why his proposed experiment would fail to answer the question under consideration. Having thus seen that each is prepared to carry out an experiment which promises a correct and reliable answer to the question asked, we shall be in readiness to begin out-of-door work as soon as the season will

allow. Each will then be allotted sufficient land for his purpose, and furnished with all the necessary material as it is needed. He will be required to keep an accurate account of all material furnished him from the farm and of all labor of teams, his own labor and expenses of all sorts.

In the execution of work, each student will be left largely to himself; but I shall exercise a general supervision over the whole in order to see that nothing is done improperly. The crop which he raises will be purchased of him by the farm at a fair valuation, the value of seed or other supplies furnished him, the labor of teams and rent of land being deducted from it. Besides accomplishing the prime object in view—the training in the methods of exact experiment—this plan will give valuable practice in the keeping of farm accounts; and, since the recompense depends partially upon the resulting harvest, will stimulate individual enterprise and industry. Wherever the experiment tried is of such a nature that a good crop cannot be expected, the amount of pay will be dependent upon the value and accuracy of the result obtained and the amount of labor required to obtain it; and in all cases the getting of an accurate result, in so far as the method pursued is capable of yielding such, will be regarded as of vastly more importance than the simple production of a large crop, and will be recompensed accordingly.

While the principal design of these experiments will be the training of the students, it will also be my aim to make them of such a nature that the results will be of practical value to the agriculturists of Hokkaido.

Actual practice in the details of farm management

and the superintendence of workmen will be given late in the course, when the students will have become qualified for such work. This I propose to effect by making one or more of them at a time associate superintendents with me, each in turn being required to serve. I shall require the student or students performing such duty to bring to me each day a plan of farm operations for the next day. This plan I shall criticise and correct as may be necessary, and then allow them to superintend its execution under my general supervision.

During the past year, I have made use of students as farm interpreters, whenever one has been needed, it being the duty of each in turn to serve in this capacity a certain number of days, and, although on account of their inexperience, I sometimes find difficulty in making myself understood, I regard the benefits of the practice to them as more than counter-balancing such slight inconvenience, and hence shall continue this practice.

To gain the necessary instruction in the methods of doing farm work, the students during the earlier portion of the course labor in the field six hours each week under my direct superintendence, whenever the weather will allow. Their work will be made to cover as wide a ground as the time will permit, and will include the planting and harvesting of crops, the making of permanent improvements, the use of farm machinery and implements, the care of animals and the driving of teams both of horses and oxen. I have adopted the practice of paying for such labor at the rate of five cents per hour, more for the sake of cultivating habits of industry, and economy in the use of money than as wages. The students are thus made to

see that, to get money, it requires exertion on their part, and hence they more fully appreciate its value. That they may become useful citizens and officers, it is essential that habits of industry and of making a proper use of money be acquired in their youth; I have therefore employed such as were not otherwise engaged to work upon the farm during vacation, whenever they have chosen to do so.

During the summer vacation, I, with three students, made a trip for the purpose of collecting botanical and geological specimens and studying the agricultural resources of the region passed over. We visited Tomacomai, Mororan, Oshamambe, Iwanai, Yoichi, Otaro and points intermediate between these places and Sapporo, following the regular roads from one place to another on horseback, with one or two exceptions, where to avoid long, rough and uninteresting roads we made crossings in boats.

As will be seen by any one familiar with the country, our route led us, for the most part, along by the seashore and over ground well known before, so that new discoveries could hardly be hoped for even with a through inspection, which the time at my disposal would not allow.

Notwithstanding the hurried manner in which we travelled, quite a large number of plants peculiar to the seashore were collected and preserved, and these will be added to the herbarium in process of collection for the college. Many of these flowers were of exceeding beauty, and the general character of the seaside vegetation was in most places remarkably luxurious. Beautiful pinks everywhere filled the air with fragrance, and the evidences were abundunt on every side that, shortly before our visit, roses had fairly covered

the ground with a mass of bloom. A very handsome large blue flower, Plantycodon Grandiflorum, was found in large numbers in one locality between Horobetsu and Mororan. Some very fine ferns were collected, but most of the inland plants which we met were similar to those growing in the vicinity of Sapporo, and hence were passed by.

A trip to the coal mines near Iwanai rewarded us with a few good specimens; but, aside from these, the region passed over was geologically uninteresting. Much of the land between Shimamappu and Tomacomai consists of a black, apparently fertile soil, covered with a deposit of volcanic scoriae, the thickness of which varies from two to five inches.

It would seem to be wise to plough a portion of such land deeply, and experiment as to its crop-producing power; for, if such treatment will insure good crops, this land will become valuable for settlement after the more immediatly fertile sections are occupied. The hills of moderate elevation near Mororan are such in appearance as those found to be most suitable for sheep husbandry in America, and if, as I doubt not they can be, they are made to produce sweet grasses instead of the bamboo which now grows upon them, they will become very valuable for this purpose.

I was particularly pleased with the appearance of the village of Monbetsu, the great buildings and fields of the farmers betokening thrift and comfort, and plainly showing the results attainable with intelligent labor in most parts of this island, for the land here was apparently no more fertile naturally than that in many other places.

Through the kindness of the chief officer of Iwanai, we were shown two extensive tracts of land lying near

that place which appear to be well fitted for pastures or for cultivation, the natural vegetation being exceedingly luxurious. Some portions of it, however, lie so low as to make the question of drainage one of some importance; but how difficult it would be can, of course, be determined only by a careful survey.

While the number of specimens collected was not as large as it might have been had we passed over new ground, I regard the trip as having been a profitable one because of the knowledge of the country which we gained; since, only when we understand the nature and needs of a country, can we so direct our labor as to produce the most valuable results.

In conclusion, I wish to testify to the great interest taken by all the students in the studies and work which we have pursued, as also to their exceeding faithfulness and politeness in the performance of all duties.

I have the honor to remain, Sir,
Your obedient servant,
Wm. P. Brooks,
Professor of Agriculture.

REPORT

OF THE

FARM DIRECTOR,

Wm. P. BROOKS. B. S.

FARM REPORT.

I commenced the active discharge of my duties as Farm Director on the first of April last, and, though I labored under some disadvantage on account of ignorance as to the precise nature of the soil and climate with which I had to do, I am happy to feel justified in reporting a fair degree of success in all the operations of the farm. Commencing my duties as I did, entirely without experience or knowledge of the farm, and hence having no exact ideas with regard to what questions, if any, demanded experimental determination, I have confined myself entirely to ordinary routine work in the raising of crops, care of stock and the making of permanent improvements. I have constantly endeavored to have all kinds of farm work done in the most approved manner, aiming to impress upon all persons employed upon the farm the importance of accomplishing as much as possible with a given amount of exertion; but we have labored under a disadvantage in some instances on account of not having the best tools and machines; these, however, will all be in readiness for the work of the coming season, having been already ordered. I have sought to lead my laborers to think about their work, to use their judgment, their common sense; and not to work blindly like mere brutes. Both brains and brawn are essential to a good workman; the former, if well employed, enabling him to accomplish vastly more with a given amount of muscular force than he could otherwise accomplish.

I have found a constant tendency among my workmen to under-rate their ability, arising probably either from natural modesty or still more natural indolence.

One man never thinks that he can accomplish anything alone, whereas the fact is that, in many instances, he could, with very slight additional effort, do the work for which he thinks two men necessary. I have endeavored to overcome this tendency as much as possible, not merely for the sake of present economy in the performance of farm work, though that in itself would be a sufficient object: but because I deem it to be vitally important that the people acquire this habit of striving to do as much as possible with a given amount of individual effort. If one man by the exercise of a little thought or an inconsiderably greater portion of his physical strength can do the work which two have been in the habit of doing, the valuable products of his labor will be doubled, and if this be the case throughout a nation, its wealth and the possible comforts of its people must be increased in a like ratio. This desire to accomplish much with little effort often leads, also, to labor-saving inventions; and laziness which manifests itself in this direction is laudable rather than to be condemned. It is stated that one of the important parts of the steam engine was suggested by the invention of a boy who preferred play to the labor which it was his duty to perform. A spirit of invention is a considerable element in the sum of the requisites for national prosperity, and should be fostered in all possible ways.

It is equally important to economize the working force of a nation in order to make it produce as much as possible. I have endeavored not to fall into the idea that, because labor is cheap here, it is unimportant to economize it: but, while I feel that I have made some improvement in this direction, I am aware that much more is possible. My time, however, is so

fully occupied, devoting as I do nearly all of every forenoon to my duties in the class-room, and four afternoons of each week to practical work with the students, that I cannot devote as much time as might profitably be so spent to the personal supervision of work in the field. There is certainly a chance to effect a large saving in this direction, and I shall make it my constant effort never to have a superfluous man engaged in the performance of any task.

There is also a tendency among my laborers to perform unaided, work which can as well and much more cheaply and quickly be done with the assistance of a team of horses or oxen. This however I do not regard as strange, since they have not been much accustomed to working domestic animals, and hence do not understand how to avail themselves of their strength. It is, nevertheless, as unwise to employ a man to perform work which can be done more economically by the use of brute force or mechanical contrivances as to employ two men to do what one might accomplish. It is clearly injudicious to allow men, who are capable of performing labor which requires the exercise of the brains which have been given them, to spend their time in doing such work as hauling heavy loads and grading land, when these operations can be much more cheaply accomplished by properly applied brute strength. I have therefore made it my constant rule never to employ a man to do what could be done by horse or ox labor with the appliances at my command; but in some instances, through lack of the proper machines or implements, I have not had work done as I would have liked. This policy, on account of the inexperience of the workman, may in some instances cost more at first, than to allow them

to work in their accustomed way; but I consider it to be very important to teach them to make use of the strength of animals wherever and whenever possible. Should the labor of the people of this province be properly applied, properly economized, and should they learn to make proper use of animal strength and labor-saving inventions, the productive capacity of its laborers would be largely increased and hence its material prosperity and the comforts possible to its inhabitants would be increased also.

As an illustration of what may often be gained by a use of proper appliances with which to do work, I may cite the following instance:—Last year one hundred kokus (about sixteen tons) of Fish Guano was purchased at Otaru for use on the College Farm, the cost of transporting which on pack-horses from Jenibako, to which place it was brought by boats, to the farm was about ninety-five yen. This year two hundred and fifty kokus (forty tens) have been brought on wagons and sleds from the same place by the farm teams, and making a liberal allowance for the cost of the labor of men and animals employed and for the wear of vehicles and harnesses, the expense has been only about forty yen. In other words, two and one half times as much material has been transported for considerably less than half as much money. And I may add here, that, had the road over which this transportation was done been better, the saving effected would have been correspondingly greater.

It had always been the custom on the farm here to pay all day laborers the same price without regard to their several ability, and hence a man had but little incentive to lead him to do his best. A man was regarded as a man, and whether he did much or little

his wages were the same. This I conceive to be a practise, very pernicious in its effects, stifling, as it must, all individual ambition, and leaving a man no hope of bettering his condition by the exercise of energy and enterprise. I have therefore adopted the rule of graduating the wages of my employes according to the amount of work which each shows himself able and willing to perform, and have, thus far, had every reason to be more than satisfied with the result. The common laboring classes need to be roused from the long sleep of feudalism in which they have been living, and to be shown that their well-being and prosperity depend upon individual effort, and that it is possible for them to better their condition immensely. Contentment is, of course, a very desirable characteristic in a people; but to be contented to live in a miserable hovel and on the very coarsest food, as many of the lower classes appear to be, is evidently not a quality which will ever aid materially in increasing the wealth of a nation. I hope soon to see the day when no laborer can be found in Hokkaido whose time is not too valuable to be employed in transporting heavy burdens long distances, for such work can better be done by horse or steam power.

CROPS CULTIVATED.

During the past season we have raised upon the College Farm 38.6 acres of corn, 2.6 acres of beets, 16.5 acres of potatoes, 20 acres of oat fodder, 11.2 acres of millet, 13.9 acres of barley and 1.5 acres of fodder corn, besides small areas each of beans, cabbages and carrots.

GRASS LANDS.

About twenty acres have been sown with grass seed, thirteen being sown together with oats in April, and about seven acres being sown with grass seed alone in early autumn. In both cases, the grass has started remarkably well, and, as both received a top dressing of fish pomace in the fall, I anticipate large crops the coming season, particularly from that sown in the spring, as in this piece the grass has got more deeply rooted than in the other.

The climate here is so moist that the plan of sowing grass seed in early spring with such grains as oats or barley seems to promise excellent results. If the grain, however, is allowed to ripen, it, of course, draws heavily upon the ground, and the young grass should receive a liberal supply of manure soon after the grain is harvested. The fall also must be a very excellent time to sow grass seeds, as the abundant rains common at this season give the grass a fine start, and the thick blanket of snow in winter protects it from severe freezing. Either season is good then; and whether I would sow grass seed in spring or autumn would depend upon circumstances. If I wished to raise a crop of oats or barley, either for fodder or grain, upon the land which I was intending to sow to grass, I would sow the grass seed with the grain as early as possible in spring; but if I wished to raise such a crop as early potatoes or indeed any crop which could be harvested as early as the middle of September, I would not hesitate to do so, reploughing the land and sowing the grass seed as soon as practicable after the crop is removed. If the crop can be harvested as early as the twentieth of August, I would sow the seed

then, as it would get a more vigorous start before being checked by frosts, and hence be likely to produce a better crop the following summer. The climate here seems to be admirably adapted to the production of grass, and therefore there can be no doubt that stock raising and the production of dairy products may become highly successful.

CORN.

The area planted in corn received an application of five hundred pounds per acre of fish pomace, which was scattered broadcast and harrowed in, just before the corn was planted. The corn was planted in rows three and a half feet apart, five or six kernels being dropped at intervals of two feet. The planting was all done by hand, as, on account of imperfections in its structure, it was found impossible to use the planter which had been made in Tokio. The planting was commenced on May twenty ninth and finished June fifth. A device, which was resorted to prevent the myriads of crows from pulling up the corn, was the means of saving an immense deal of trouble, and is worthy of mention. The grain was first soaked about ten hours in water which had been made quite salt, the salt being, however, for another purpose which I will mention further on, and not necessary as far as the crows were concerned. The corn was then taken out of the brine and allowed to drain a few moments, when a small quantity of tar was added, and the whole thorougly stirred until each kernel was seen to be covered with a very thin coating of it. Air-slaked lime enough was then mixed with it to make the grain moderately dry and convenient to handle. This

treatment does not injure, in the slightest degree, the germinating quality of the seed; and it is perfectly certain to prevent the crows from troubling it, as was conclusively shown on the college farm. A small piece was planted with fodder corn and, as we did not have enough corn tarred to quite finish the field, a few rows were planted with grain which had not received any tar. Both kinds of seed came up equally well, and for a few days grew with equal vigor; but, some enterprising crow happening to discover that a part of it had not received its armor, the result was that in one day he with a few of his countless brothers pulled up almost every kernel of that seed which was planted without tar. The line of demarkation between the tarred and untarred was perfectly distinct; and though occasionally one or two kernels were pulled up in the rows next to the untarred portion, they were left lying uneaten upon the surface of the ground.

Last year a disease known as smut, which is simply a fungoid growth upon the grain, was very prevalent in Massachusetts, from which state the seed planted here this year was brought; and fearing that the spores of this plant might have been introduced with the seed, I added the salt, of which I have spoken above, to the water in which the corn was soaked, for the purpose of killing these spores. Whether our corn would have been affected by smut if we had not soaked the seed in brine, I can not say, as I caused all the seed planted to be treated alike, not wishing to run any risk of introducing this disease; but this is certain:—that though the weather here was such as is considered particularly favorable to the growth of this fungus, our corn was entirely free from it.

The corn was cultivated three times with a Bertrand

and Sames sulky cultivator, and once with a one horse cultivator after it had become too tall for the use of the wheeled implement, and it was hoed slightly twice; but not much hand labor was required. When hoed the first time only the three best spires of corn were left in a place; the culture was level. This amount of work kept the weeds down very effectually in all except about five acres, where a deep rooted vigorous kind of grass had become so thoroughly established as to defy our efforts to exterminate it. This grass seems likely to become a very pernicious weed, and great pains should be taken to kill it out when it first appears in any cultivated land. With the culture given, one field of eighteen acres yielded about sixty-six bushels to the acre on the average. Another field of twenty acres yielded on the average fifty-eight bushels; but part of this field I am confident yielded as much as eighty bushels to the acre, while other parts, where the grass of which I have spoken grew, did not probably produce at the rate of more than forty bushels.

These yields are very good, the average in Massachusetts not being more than forty bushels; but I am certain that I can produce larger ones with more liberal manuring. The past season we had no barnyard manure fit for use, the animals having been bedded so abundantly with Hokkaido hay that it was found impossible to use the manure, which was somewhat sparingly mixed with the hay, before the latter was decomposed. It would have been like applying the small limbs of trees to the land to have used it in its undecomposed condition. It has been worked over, however, and is now thoroughly rotted and will be excellent for use the coming season; in fact part of

it has been already hauled out upon the land and spread.

POTATOES.

The land on which potatoes were planted received five hundred pounds of fish pomace and ten bushels of ashes per acre, both of these being spread broadcast and harrowed in. The potatoes were all planted before May twentieth in hills three and one-half feet apart each way. They were cultivated three times and hoed twice, and the resulting harvest was a very fine one, averaging two hundred and seventy-four bushels to the acre of fine large tubers. I attribute this fine yield largely to the ashes applied, for the potato is a crop which requires a large amount of potash which the ashes furnished. Most of these potatoes were stored in pits, and we are now feeding them to all our stock in as large quantities as the animals can safely eat. All relish them very much, and are thriving exceedingly well.

FODDER CROPS.

The crops of millet, oat fodder, Timothy and clover raised the past year were all good, and were secured in fine condition, they together with a portion of the corn fodder filling our large new barn to its utmost capacity. A large amount of the latter was stacked in the field on account of a lack of space in the barn. The expense of housing our fodder crops was somewhat greater this year than it would have been, had the drive-ways leading into the barn been ready for use in season; but the delay was not wholly avoidable, being caused, partly, by the change rendered neces-

sary on account of the pressure of the earth embankment against the walls of the barn, of which I shall speak subsequently.

BEETS.

The area planted with beets received about ten hundred pounds per acre of Fish Guano, which was scattered broadcast and harrowed in just before planting the seed. The ground was very thoroughly pulverized by the use of the harrow, brush and roller, and we commenced to plant the seed May eighth, finishing on the fourteenth. The work of planting and cultivating was all done by hand, as we had no machines for such purposes. The culture was very thorough, not a weed being allowed to grow, and, though the young plants were preyed upon severely by worms which worked with exceeding rapidity in the very early morning or at night, burying themselves in the ground during the day, the resulting harvest was a good one. An application of air slaked lime made while the plants were wet with dew seemed to be effective in preventing the ravages of the worms which I have mentioned above; so, if care is taken, it will probably be quite easy to protect the young plants from them. We shall study the habits of this insect and report further in due time. The beets raised were nominally of six varieties: — White Imperial Sugar, Early Blood Turnip, Egyptian Dark Turnip, Long Dark Blood, Yellow Globe Mangel, and one marked simply California Grown Beet Seed. Both kinds of Turnip beets, the Long Blood and the Mangel, seemed to be true to their names; but, unfortunately, the seed of the sugar beet seemed to be very much mixed, there appearing at harvest no less than

three distinct kinds. The seed was planted in drills twenty inches apart, and the intention was to leave the plants eight inches apart in the drills; but, as the seed germinated poorly, there were many vacant places among the sugar beets. If the plants had been as thick as intended, I am quite certain that the crop would have been twice as large as that realized. The growth throughout the season was remarkably vigorous; and the roots grew to a very large size, the largest weighing ten pounds, the average weight being estimated at three pounds. I was well aware that such a rank growth was not favorable to the formation of a large percentage of sugar, and anticipated, in a measure, the results which the tests for sugar showed.

In my opinion there are several causes which helped to bring about this result.

First.—The extreme humidity of the climate causing, as it did, an extremely rapid and rank growth. This was undoubtedly the prime obstacle to the growth of a beet rich in sugar.

Second.—The superabundant nitrogenous matter in the soil, this also being favorable to the production of a root of large size rather than of good quality.

Third.—The manure applied was not well suited to promote the formation of sugar, being deficient in potash which is regarded as very essential.

Fourth.—The seed planted was of such an uncertain character, that we should not be entitled to make any final decision in regard to the possibility of raising a good beet here, even if all the conditions of growth had been the most favorable.

The weather must, in my opinion, always remain somewhat of an obstacle to the production of a beet

of the very finest quality; but while this is a disadvantage, it is partly counterbalanced by the increased quantity of roots which the abundant moisture produces. Thus though the percent of sugar may always be somewhat less in our beets than in those grown in a drier climate, the quantity produced upon a given area would be as great or perhaps even greater. The nitrogenous matter in the soil will be constantly growing less, and, after a few years cultivation, no injurious effects need be apprehended from this source.

Charles A. Goessmann, Ph. D., who is the acknowledged authority on the sugar-beet question in America, says in the Ninth Annual Report of the Massachusetts Agricultural College : — "Woodlands and prairies but recently put under cultivation are not fit in their original state for the cultivation of a good sugar beet, because their mineral elements find more than their equivalent of suitable organic and particularly of nitrogenous plant food, which favors a luxurious growth altogether different from what the beet-sugar manufacturer desires .....These very same lands, if of a more sandy than clayish nature, with a permeable subsoil, may prove, in consequence of repeated cropping, sooner or later, a most excellent soil for the cultivation of sugar beets."

Now the soil of this vicinity is precisely of this description ; it is more sandy than clayey and it has a very permeable subsoil, and, though at present too full of nitrogenous plant food, every year of cultivation will make it more and more suitable for the growth of beets of good quality.

I anticipate that wood ashes will be the best fertilizer available in this vicinity, and shall experiment with them the coming season. If barn yard manure

is used it should be that which has been very thoroughly decomposed. I have already taken the necessary steps to procure mineral fertilizers of various kinds, and shall determine the effect of different combinations of phosphate of lime, potash salts, magnesia, lime etc. both upon the quantity and quality of beets produced. I have also ordered a supply of seeds of two of the best varieties of sugar beets, and it is to be hoped that they will prove to be what they purport to be.

A statement of the cost of raising the crop of this season, which it will be seen is quite small, follows below; but I will say here that, though the cost here given compares favorably with that in other countries, it can be made considerably less by the use of proper implements, and would have been much less this season had there been no vacant places caused by the failure of some of the seed to germinate.

Area cultivated, ½ Acre.

	Dr.
Cost of ploughing	$ .40
„ „ harrowing	.40
„ „ planting	2.00
„ „ hoeing and weeding	3.00
„ „ manure, 500 lbs., fish guano.	4.00
„ „ harvesting.....	3.00
Total cost of 10 ¼ tons of beets....	$12.80
Cost per ton.....	$ 1.25

This cost appears here to be larger that it really should, for the land is now in much better condition, both as to the elements of plant food and physical condition, than before the beets were raised upon it, and yet I have charged the crop with the full cost of

manure and cultivation. The results of the past season should not be regarded as decisive in any respect, nor as being discouraging to any considerable extent. I have the strongest confidence that, when we shall have determined experimentally the best methods of culture and the proper manures for this soil and climate, it will be possible to produce excellent beets in large quantities and at a very small expense.

PERMANENT IMPROVEMENTS.

In addition to the work of raising the crops which have been described, we have vigorously prosecuted the work of improvement. We have ploughed up and levelled off a large number of old and useless roads, built and graveled a new road from the highway to the barn, a distance of nearly $^1/_3$ of a mile; and also built a new road from the barn toward the lower end of the farm, about one-fourth of a mile in length. A large amount of grading has been done about the new barn; and three and a half acres of land have been cleared of stumps, ploughed and planted, producing without manure the best corn of the season. More than three and a half acres of land in one of our cornfields was rendered worse than useless this year by the presence of a large number of trees in it, as they furnished excellent shelter both for weeds and crows, and it was impossible to raise corn in their shade. These trees together with a large number which grew in a low swale at the lower extremity of the farm have all been cut this autumn, and thus the amount of land available for cultivation has been largely increased. In order to fit this swale for the production of profitable crops, it requires thorough drainage. Accordingly, though the land was exceed-

ingly wet on account of the frequent heavy rains of the late summer and autumn, a considerable beginning has been made on this work, we having dug two hundred and sixty-four rods of ditch, two feet wide at the bottom and two and a half feet deep. The cost of this ditch was thirteen cents per rod. A part of it is in the wild land now used for pasture, the proposed improvement of which I shall subsequently speak of. Should the weather of the coming spring be as favorable for the prosecution of such work as that of last, I shall have this ditch still further deepened, and in a part of it at least shall lay a wooden drain, somewhat similar in construction to the one which I have laid in the barn cellar, a detailed description of which will be found further on.

IMPROVEMENT OF PASTURE.

The grasses at present growing in our pasture are not such as are suitable for the production of dairy products of the first quality, and therefore I shall aim to replace them as rapidly as practicable with English grasses of known excellence. To this end I have had the grass, weeds and brush on about thirty acres of it mowed, and that not suitable for bedding burned. This land has been separated from the remainder of the pasture by eighty rods of fence similar to the one described by President Clark in the last report; and it will be in excellent condition to plough in the spring, when it will be planted with an early variety of potatoes. These will be carefully cultivated during the season to kill the wild plants, and the land will be sown with grass seeds in the fall after the potatoes are harvested.

DRIVE-WAYS AT THE BARN.

Soon after the earth drive-way in front of the barn was constructed, it was found to be exerting such a great pressure against the wall of the barn as to endanger its stability; and in order to obviate this difficulty, I had the earth which lay next the barn removed, and a bridge built to span the space. The width of this space at the bottom is twelve feet, and the end of the earth embankment slopes slightly away from the building, being protected and held in place by strong wood work which supports one end of the bridge; the other end rests upon timbers placed close to the side of the barn. On each side of this bridge is a substantial railing three feet nine inches in height. By this change, without lessening in the slightest degree the usefulness and convenience of the driveway leading into the hay floor, we have not only accomplished the end primarily in view—the removal of the pressure against the walls of the barn—but, what is of almost equal value, have opened a passage way around the front end of the building, which we find to be exceedingly useful. A very strong wooden drive-way, supported upon posts firmly set in the ground and thoroughly braced, has been built from the rear entrance to the hay floor to a point within about four feet of the surrounding level, a distance of 84 feet. From this point the drive-way is of earth, the length of this portion being 60 feet, making the total length 144 feet. The wooden part extends 32 feet from the barn in a straight line and then turns to the right, reaching a direction at right angles to the original one by a uniform curve, 20 feet in length, measured on the centre line of the drive-way. This direction is maintained from this point to the end of the way.

The grade is uniform throughout, being about seven feet in one hundred. The width is the same as that of the barn floor, 16 feet, and on each side is a railing similar to the one on the bridge in front of the barn. The design for this work was kindly furnished by President Wheeler. The method of structure described was rendered necessary by the peculiar location, and by the fact that, in order to have convenient access to the cellar, it was necessary to pass freely under this drive-way; and I will add here that it has been found to answer all its requirements admirably, the grade being so gradual that it is almost equally as easy to draw in loads over this, as over the front one.

CELLAR DRAINS.

The location of the barn is such that the cellar under it was found to be very wet, so much so, in fact, as to make it almost impossible for either man or beast to go into it. Some method of drainage was therefore imperatively demanded, and, as tiles could not be conveniently procured, I have put in box drains. The cellar is fifty feet wide, and, I have laid through it two lines of boxes, one nine feet from either side-wall, the two lines being united into one of like construction near the point where they leave the cellar. The boxes are made of durable planks one and one-half inches thick and of any convenient length, so put together as to form an orifice, the cross section of which is a right angled triangle, whose sides are each six inches long, the hypothenuse being about eight and one-half inches in length. In each side are two rows of holes three-eighths of an inch in diameter, so placed that the distance from each edge of the box to the nearest

row of holes is equal to the distance between the two rows. These holes are three inches apart in the rows, and are arranged in such a manner that each hole in either row is opposite a space without a hole in the other. The ditches were excavated to the average depth of two and one half feet, this being as deep as the outlet would allow, and with a fall of five inches to the hundred feet. In these, the boxes were placed end to end with the apex of the right angle down, care being taken to have the slope uniform throughout the entire length of the drain. They were then carefully covered with three inches of fine gravel, particular attention being paid to packing it closely about the boxes, both on the sides and top. The ditches were then filled with the earth which had been taken out of them, it being tamped in till quite hard. This drain extends about one hundred feet from the cellar, where it empties into an open ditch leading into the brook directly back of the barn. Where one drain unites with the other and wherever the direction changes, care was taken to so arrange the boxes that one current of water should not strike another at right angles, as this might result in a deposit of sediment at such a point. In all such cases the direction of the drain was changed gradually; the water of one drain thus joins that of the other with nearly the same course. This system of drainage has thus for worked better even than I anticipated, the cellar having been perfectly dry and hard ever since it was finished.

THE MODEL BARN.

The model barn was completed n season to receive our large crops of hay and fodder, and in the early

autumn our cattle and horses were moved into their new quarters, where, if one may judge from their appearance, they find themselves exceedingly comfortable. A good warm barn effects a great saving in food, since much less is required to keep up the animal heat; and boards and shingles, properly disposed, are much cheaper for fuel than corn. Our barn has already abundantly demonstrated its utility in the matter of saving labor, because of its convenient arrangement, three men now taking all the care of twelve horses, thirty-two neat cattle and ten hogs, besides doing some outside work; while last winter at this time, it required the almost continuous labor of six men to care for ten horses and ten neat cattle. When we have better arrangements for bringing water to the barn and the proper machines for cutting roots and fodder, the work can be done still more cheaply.

CORN BARN.

True economy demands that such buildings be provided for the storage of all kinds of farm crops that they can be conveniently stored so that no waste shall occur after the crop is harvested. I have therefore had a corn barn built which I believe will fulfill this condition admirably. The building is framed in American style, is forty by thirty feet in size, with fifteen-feet posts; and sets upon sixteen stone posts, each one-feet square and seven feet long. These posts are set into the ground four feet, and each is capped with a plank, two inches thick and two feet square, around the edges of which are nailed strips of sheet iron five inches wide, the iron thus projecting three inches below the lower edges of the plank. The steps leading into the build-

ing are movable and are always taken down when not in actual use. This arrangement makes it impossible for such vermin as rats and mice to gain access to the corn, for they cannot climb the stone posts and crawl around the caps which are placed on them. The outer covering of the building is like that of the barn. It is divided into two rooms, an upper and a lower, by a floor twelve feet above the lower one. In the lower room are the bins for the storage of corn; and the upper one is to be used for the storage of seed corn, other grains, such as wheat, oats and barley, grass seed and all the various kinds of seeds which we may raise or have at any time. The walls of the bins for corn are all made of strips three inches wide and one and one-half inches thick, which are placed three-fourth of an inch apart. The bottom of each bin is composed of similar strips nailed upon four-inch joists, thus leaving a space below for the circulation of air. Six boards of the outer wall on each side of the building are so hung on hinges that they can be thrown open at any time, thus allowing a free circulation of air whenever desirable. Windows are also so arranged that when open they admit of the freest passage of air currents.

The building affords storage room for about two thousand bushels of corn, several hundred bushels of other grain and a large quantity of seeds of various kinds, besides convenient room on the lower floor for shelling corn.

COLLEGE GROUNDS.

Besides the work on the College Farm proper, we have performed considerable labor on the College

grounds in grading and seeding to grass about the buildings, and here we also raised about three acres of corn and two acres of oat fodder. Both of these crops yielding fair returns, they just about paid us for the labor bestowed upon the permanent improvement of the grounds. Our teams have also done some work in the transportation of coal for the laboratory; but the amount is inconsiderable. I have considered the items against the College to be balanced by the value of the crops produced, and hence have made no charges.

STOCK.

Our stock of neat cattle consists of the following animals: — *Shorthorns*, five cows, one bull four years old and three young bulls; *High Grade Shorthorns*, four heifers about three years old and one heifer calf; *Nambu cattle*, four working bulls, twelve young bulls and three heifers. The shorthorn and grade animals are all excellent specimens, and have been uniformly healthy and thrifty throughout the year. They all show an extraordinary aptitude to lay on fat, even though not fed very rich food; but the cows are nearly destitute of milk-giving qualities, especially the thorough-breds. The grade heifers promise better in this respect. The Nambu bulls, though very slow, are as sure as they are slow, which is saying a great deal, and they answer an excellent purpose for heavy work in rough places. It is proposed to castrate the young bulls at an early day, and train them thoroughly for work.

SWINE.

We now have ten pigs, weighing about one hun-

dred and twenty-five pounds each, five of them Berkshires, and five white pigs, apparently of no particular breed, but very good animals. These pigs are kept in the cellar under the barn, and are nearly paying the cost of their food by their very efficient services in working over the manure of the horses and cattle which is thrown down from above, while they are at the same time growing very rapidly.

TEAMS.

Our teams consist of nine Nambu horses, three Hokkaido horses, and the four bulls which I have mentioned above. On account of their small size, we are obliged to keep many more horses than would otherwise be necessary, as we find that under constant heavy work they rapidly grow poor; and in order that the men may loose no time, we must have enough animals to change occasionally and give an overworked team a few days rest. A larger breed of horses for drawing heavy loads is very much needed.

CARE OF STOCK.

In the care of stock and teams, I insist upon the utmost regularity as to the hours of doing all the various kinds of work such as feeding, watering, bedding, cleaning, milking etc. This regularity is of the highest importance, as it has been repeatedly proved that animals treated in every other respect in a precisely similar manner, but cared for at irregular hours, will not thrive nearly as well as those, in the care of which the greatest pains are taken to do everything at stated regular intervals. I also enjoin the

strictest kindness in the treatment of all our animals, well knowing that this is absolutely essential in order to the attainment of the highest success. We feed a great variety of food each day, as by this means we tempt our animals to eat more than they otherwise would. Our neat cattle are fed at present upon the following articles: — potatoes, corn meal, oat fodder, millet, Timothy hay and corn fodder. Our horses have potatoes, corn meal, oat fodder and millet; and our pigs, potatoes and corn. I require strict economy in the feeding of all kinds of stock, endeavoring not to have anything wasted. This is wise, not only as a matter of economy, but also because the animals themselves will thrive much better when fed just so much as they will eat and no more. They seem to become dainty if too much is placed before them. All our animals have been uniformly healthy and have grown very rapidly.

FINANCIAL STATEMENT.

The following is a statement of the expenditures, receipts, and products of the College Farm from April 1st. 1877 to January 1st. 1878:—

Farm Labor. .....Yen 2058.261 *

BUILDING EXPENSES.

Entrance Gate and Fence.	Yen 81.383
Drain Box and Drain	8.550
Pump Platform	1.100
Open Shed	364.839
Work on Barn	243.076

* The yen is equal to $.997 U. S. gold.

Farm Bridge	4.550
Barn-yard Fence	46.066
Room for Farm Students	50.812
Bedsteads, „ „	9.606
Barn Drive-ways and Work on Barn	696.741
Cellar Drains	111.325
Corn Barn	709.653
Pig Pens	76.777
Pasture Fence	36.795
Total	Yen 2441.228

GUANO.

Expenses of Transporting Guano used in 1877,	Yen 120.007
Expense of Transporting Guano to be used in 1878,	42.730
152 Kokus to be used in 1878,	312.850
Total	475.587

Hay, Wheat, Barley, Beans, and Bran.	Yen 1011.328
Millet, Carrot and Turnip Seeds	39.946
Six Nambu Horses and Expenses of Transportation	377.614
Horseshoes and Blacksmith's Repairs	102.060
Carpenter's Repairs and Work	40.462
Transportation of Machines, Implements and Seeds	56 187
Mats for Hay Covers	23.300
Sundries :—Including Ashes, Yokes, Oil, Tar, Lime, Baskets, Japanese Scythes, Farrier's Tools, Balances, Measures, Mats, Clock, Matches, Lanterns, Candles, Nails, Repairs on Harnesses, Bull Harness, Ropes for Measur-	

ing Land, Feed Tubs, Soap, Pails etc 190.123

Total Expenditures..... Yen 6816.096

RECEIPTS AND PRODUCTS.

Timothy Hay,	43.4	Tons	@ Yen 10...	Yen 435.00
Millet „ ,	21.	„	9.....	189.00
Oat Fodder,	51.75	„	9.....	465.75
Corn „ ,	120.	„	5.....	600.00
Barley Straw,	9.	„	4.....	36.00
Wild Hay,	5.	„	4.....	20.00
Corn,	2450	Bushels @	.60...	1470.00
Potatoes,	4500	„	.30...	1350.00
Beets,	1318	„	.20....	263.60
Beans,	27	„	1.00....	27.00
Barley,	184	„	.55....	101.20
Timothy Seed,	15	„	1.50....	22.50
Durham Calves,	2		30.00....	60.00
Grade Calf,	1		.....	15.00
Wood, Cut,	40	Cords	1.00....	40.00

Total Products. 5095.05

RECEIPTS.

For Milk, 225.27 Gallons, @ Yen .24...Yen 54.065
„ Horses, 4 ..... 52.000
„ Oat Fodder and Wild Hay, ... 25.000
„ Cabbages, ... .600
„ Wood, ... 7.125

Total Receipts ..... Yen 138.790
Total Farm Credits .....Yen 5233.84

The prices stated for the various farm crops are the market prices of the same articles in Sapporo; in all

other cases I have given a value, based upon the comparative worth for stock-feeding purposes of the crop in question, and think that I have placed the valuation low rather than high in every instance.

FUTURE MANAGEMENT OF THE COLLEGE FARM.

With regard to the future management of the College Farm, it seems appropriate that I should say a few words before closing this report. The policy of improvement which has thus far been adhered to will receive as much attention in the future as in the past, the aim being to bring the farm as soon as possible into the most perfect condition in all respects. The *science* of agriculture is yet in its infancy, although the *art* is as old as man; and immense improvements are yearly being made in its methods as our knowledge increases. It will be my aim to keep abreast of the most enlightened practice, in order that the farm may be a model worthy the imitation of all. To this end I have already taken the necessary steps to procure improved machinery and tools of various kinds, and have also ordered a large assortment of seeds of the leading varieties. I have also sent for a few Ayrshire cattle, believing that they are better adapted to the needs of this country at present than the Shorthorns. The Ayrshires are eminently a milk producing breed, and when once the citizens of Hokkaido become aware how excellent a food milk is, and how cheaply it can be produced and sold, I doubt not they will be glad to avail themselves of the opportunity to buy either milk or cows; if the latter, one great step toward the improvement of their agricul-

ture will have been taken. In order to illustrate the methods of utilizing milk by making it into butter and cheese, I recommend that a building for dairy purposes be built upon the College Farm during the present year, the fine stream of running water of nearly unvarying temperature which runs through the farm offering facilities for these purposes which cannot be excelled. The production and sale of dairy products offers, in my opinion, the most promising field for a favorable financial return of any business that the farm can at present engage in.

That we may have the necessary conveniences for the breeding of horses, sheep and swine, and a room for slaughtering purposes and for cooking feed for hogs, an additional shed should be joined to the barn at an early day. It is also desirable that the Japanese foreman, farm teamsters and persons employed in the care of the dairy, should one be established, have a suitable house in which to live upon the farm. The presence of all of these persons, at all times, near the scene of their labor is very desirable; and the presence of some, absolutely essential. I shall therefore, in due time, submit plans of all these needed buildings to the proper authorities for their approval.

The importation of seeds from foreign countries at present necessitates large annual expenditures, and hence it can but be a great advantage to the Department if the necessary seeds can be produced here. In the hands of ignorant farmers many kinds of seeds very rapidly deteriorate from various causes, such as lack of judgment in selection, mixture of the pollen of different varieties when in flower, want of the proper cultivation etc. A full understanding of botany, including a knowledge of the physiology, structure and

habits of growth of plants is absolutely essential in order to the attainment of the highest success in the production of seeds. For these reasons, it appears to me that this work can nowhere else be so well conducted as upon the College Farm, or under the supervision of its officers. In order that a great variety of seeds may be produced in purity, it will be necessary to have many small plots of land widely separated, since if planted in proximity to each other many varieties will hybridize. I shall produce as large a variety of seeds upon the farm, as its area will allow; and would recommend that when the seeds which I have ordered from America are received, a few of the most intelligent farmers in this vicinity whose farms are sufficiently widely separated, be employed to plant and cultivate them under the supervision of some competent man. The Department might then buy the seeds of him in the autumn, paying a price proportional to the amount and quality of the seed raised, and deducting from it a fair amount for the original seed furnished him. This policy would, I am confident, not only attain the prime end in view—the production of pure seed—but would also furnish profitable employment to quite a number of men, and thus stimulate individual effort. Under wise and efficient supervision, this plan can not fail to be successful.

During the past year, many questions have presented themselves to my mind with regard to the nature and needs of the soil of the College Farm, the comparative value of different substances which are available for manurial purposes, the methods possible to insure the hardiness of fruit trees and the Chinese mulberry, the relative value of different cattle foods, the systems of culture which will produce the best

results, and also concerniug many other things which it is needless for me to mention here. These questions can only be answered by carefully conducted experiments, and these can best be conducted upon the College Farm. The results obtained can not fail to be of practical value to the farmers of Hokkaido. I have taken measures to procure a supply of chemical fertilizers to aid us in the solution of some of these problems, and I hope to be able to bring forward valuable results in the next annual report, though I would have it clearly understood in advance, that final conclusions can be made in regard to many of these questions only after a long series of experiments, carefully conducted and recorded.

Briefly then, to recapitulate, I think the management of the College Farm should aim to accomplish the following results: — to make it an exponent of the most scientific and enlightened practice, to make it a model of economy in its use of labor and material of all kinds, to make it a source of supply of the best and purest seeds and the best stock, to make it answer experimentally all questions pertaining to agriculture which require in their solution the application of scientific knowledge and methods, to make it illustrate the best possible manner of doing all kinds of farm work and of caring for stock, and finally, though I shall speak of this matter more fully in my report as Professor of Agriculture, to so conduct all operations as to make every thing subservient to the prime end in view, — the instruction of the College students. If these ends be attained, richly will the farm have repaid for every dollar which shall have been expended upon it.

IMPROVEMENT OF THE AGRICULTURE OF HOKKAIDO.

It must be very evident to every one familiar with the facts with regard to Hokkaido and its inhabitants that, in order that any very great improvement may be made in its agriculture, the farmers must be aroused from their lethargy. At present most of them seem to be perfectly content to move on in the footsteps of their ancestors; but, however well such methods may be adapted to the southern provinces of the empire, where the climate is warmer and the population dense they can never bring about the best results possible here. In view of these considerations, I am induced to offer here a few suggestions which, if carried out, would undoubtedly aid in bringing about the desired improvement. In order to induce the farmers to cultivate the crops particularly adapted to this region, and to lead them to do the work in the best manner, I would recommend that money prizes be offered for various purposes. Small prizes would, I doubt not insure considerable rivalry among the people for their possession, and the amount of money so spent would scarcely be noticed by the Department. There should be first, second and third prizes in each class. Prizes might for instance be offered for the best conducted farms of not less than fifteen acres, for farms of not less than ten acres, and for those of not less than five acres; the decision to be based, not only on the amount and character of the crops raised, but also upon the method and cost of doing the work. Other prizes might be offered for the best acre of corn, for the best acre of English grass, for the best acre of wheat, and so on throughout the list of desirable farm crops; and

it would be well to offer them for smaller areas of these crops also. Other prizes could wisely be offered for the best animals of the various kinds. These prizes should be awarded by committees of intelligent and disinterested men, and in all cases the cost of the production of a result should be considered. The further elaboration of this proposition at this time would be out of place; but I hope that this brief mention may awaken sufficient interest to lead to a careful consideration of its merits. I may add here that this policy is pursued frequently by American Governments in order to hasten the introduction of any desirable industry.

Another plan, which would be certain to stimulate improvement, would be the holding of annual agricultural fairs, to which the people should be urged to bring their products of all kinds. Prizes should here be offered for the best specimens of all products exhibited. Besides offering prizes for the purely agricultural productions it would seem to be wise to offer them also for agricultural implements, for the best trained animals for farm use, for the best workmen in some of the branches of farm work, trial to be made on the ground, and in short for any useful product or art relating to agriculture. Such meetings would stimulate the farmers to do better, not only for the sake of winning the prizes offered, but because they would thus meet each other, and seeing the possible results of labor properly directed would talk together and find out how such crops were raised. By rubbing together, two sticks of wood become smooth and bright; just so the friction of minds results in making each brighter and keener than before. Would it not be well to move quickly in these matters, to decide soon

upon the offering of prizes and then to advertise the project among the people, that they may begin their season's work with the intention of competing for them?

Some method of imparting information to the farmers in regard to matters pertaining to their occupation should be devised, and instruction given them as to the best methods to be pursued in the cultivation of all crops which are new to them. I have been particularly struck, in travelling through the surrounding country, with the need of information as to the care of fruit trees. Few trees that I have seen outside of the Department farms have been set out in suitable locations or at proper distances apart, and still fewer have been properly cared for. The like ignorance prevails, if one is entitled to judge from the practice of the farmers, in regard to many other plants which have been recently introduced. Would not a paper printed here in Sapporo, once a week or once a month, as should be thought best, which should give simple directions in regard to such matters, be the means of accomplishing a great deal of good? Such a paper might be printed at slight expense and distributed among the people at a merely nominal price, or given gratuitously to those who could not afford to buy it and who would make proper use of it. Should such a paper be established, I should esteem it a duty and a privilege to contribute any information in my power which could not be better obtained from some other source for translation and publication in it, in so far as the proper performance of my other duties would allow.

During this winter, on stated evenings, I am giving my farm laborers a series of familiar lectures on vari-

ous farm matters, using one of our college students as an interpreter, and I hope to be able thus to teach them something useful. If thought desirable, I might easily hold these exercises in a larger room and before a larger audience, though I should doubtless find it necessary to change the character of my instruction somewhat to adapt it to the understandings of the ordinary farmers. As soon as the Department shall have native officers who are qualified for such duty in sufficient number, I doubt not it will be the policy to give instruction of this kind through them; but cannot a beginning be made now, and here? It is certainly possible to do something; and though but little were accomplished, it would be better than nothing.

It would be unjust for me to conclude this report without testifying my gratitude to Officer Yoshida Kiyonori, the Farm Overseer, for the uniformly polite, kind and faithful manner in which he has striven to carry out all my directions. To his efficient management and knowledge of the farm, what small measure of success we have been able to attain is largely due. My thanks are also due to Mr. Mori Sadamichi, who acted in Mr. Yoshida's place during the latter's absence, for the excellent manner in which he discharged his duties. To the men who have performed the work of the farm under our direction, I would also tender their share of praise for the willingness which they have always shown to learn to do things as directed.

And finally I would especially express my thanks for the great courtesy and kindness shown me by all the Department officers with whom I have had anything to do, and also for the confidence which has

been reposed in me as evidenced by the authority with which I have been invested.

Sapporo, Feb. 1st., 1878.

CATALOGUE

OF

OFFICERS AND STUDENTS.

1877—8.

SAPPORO

AGRICULTURAL COLLEGE.

1877—8.

JAPANESE OFFICERS OF ADMINISTRATION.

Dzushio Hirotake.	Kagoshima.
Director.	
Mori Genzo.	Niigata.
Warden.	
Shimoyama Yoriyoshi.	Shidzuoka.
Assistant Warden.	
Kato Masatoshi.	Shidzuoka.
Assistant Warden.	
Ikawa Kiyoshi.	Shimane.
Librarian, Foreign Department.	
Nagao Fuzan.	Shidzuoka.
Librarian, Chinese and Japanese Department.	
Yoshida Kiyonori.	Kagoshima.
Farm Overseer.	

OFFICERS OF INSTRUCTION.

William Wheeler, B. S.,	America.
President, and Professor of Mathematics and Civil Engineering.	
David P. Penhallow, B. S.,	America.
Professor of Botany and Chemistry.	

WILLIAM P. BROOKS, B. S., America.
Professor of Agriculture, and Director of College Farm.

* .....
Professor of Physiology and Comparative Anatomy; also of English Literature.

NAGAO FUZAN. Shidzuoka.
Instructor in Chinese.

PREPARATORY DEPARTMENT.

WILLIAM WHEELER, B. S., America.
Superintendent.

* .....
Head Master.

IKAWA KIYOSHI. Shimane.
Instructor in English Language.

HORI SEITARO.
Instructor in Mathematics.

NAGAO FUZAN. Shidzuoka.
Instructor in Chinese and Japanese.

STUDENTS OF THE COLLEGE.

SOPHOMORE CLASS.

Arakawa Shigehide, ... Tokio.
Ideta Seitaro, ... Oita.
Ito Kadzutaka, ... Tokio.
Kuroiwa Yomonoshin, ... Kochi.
Nakashima Shinshi, ... Ishikawa.

* To be appointed during the current academic year.

Ono Kanemoto, ...	Shidzuoka.
Ono Takuma, ...	Hokkaido.
Oshima Masatake, ...	Kanagawa.
Sato Isami, ...	Hokkaido.
Sato Shosuke, ...	Iwate.
Tan ouchi Suteroku, ...	Kochi.
Uchida Kiyoshi, ...	Kochi.
Watase Torajiro, ...	Shidzuoka.
Yamada Yoshinori, ...	Shidzuoka.
Yanagimoto Michiyoshi, ...	Miye.
Yasuda Nagaaki, ...	Yamaguchi.
Total, ... 16.	

FRESHMAN CLASS.

Adachi Mototaro, ...	Tokio.
Fujita Kūsaburo, ...	Tokio.
Hiroi Isami, ...	Kochi.
Ito Eitaro, ...	Chiba.
Ito Kotaro, ...	Tokio.
Iwasaki Yukichika, ...	Osaka.
* Kawaguchi Munetoki, ...	Niigata.
Machimura Kinya, ...	Ishikawa.
Menjiu Komajiro, ...	Tokio.
Minami Takajoro, ...	Nagasaki.
Miyabe Kingo, ...	Tokio.
Muraoka Kumeichi, ...	Nagasaki.
Nagai Otohiko, ...	Shidzuoka.
Nishimura Kiku, ...	Nagasaki.
* Okuda Naoharu, ...	Tokio.
Ota Inazo, ...	Tokio.
Sakuma Nobuyasu, ...	Shidzuoka.
Suwa Shikazo, ...	Yehime.

* Private Cadet.

Takagi Tamataro, ...	Hiroshima.
Uchimura Kanzo, ...	Gunma.
Total, ... 20.	

PREPARATORY DEPARTMENT.

FIRST CLASS.

Dzushio Tsunenori, ...	Kagoshima.
Hori Soichi, ...	Kagoshima.
Kojima Kisaku, ...	Shidzuoka.
Nakane Toru, ...	Hokkaido.
Total, ... 4.	

SECOND CLASS.

Kon Sotosaburo, ...	Awomori.
Koseki Yoshinobu, ...	Hokkaido.
Miki Uchu, ...	Hokkaido.
Murakami Kikutaro, ...	Awomori.
Nakane Hisashi, ...	Hokkaido.
Oinouye Arao, ...	Yehime.
Ota Chozo, ...	Hamamatsu.
Sase Tatsusaburo, ...	Awomori.
Senokuchi Takakane, ...	Kagoshima.
Utsumi Kadzumitsu, ...	Tokio.
Yanase Makoto, ...	Hokkaido.
Yuki Shozo, ...	Awomori.
Yuyama Tomoyuki, ...	Hokkaido.
Total, ... 13.	

THIRD CLASS.

Hino Atsuzane, ...	Hokkaido.
Ishii Shotaro, ...	Hokkaido.

Ishikawa Kinjiro, ...	Tokio.
Iwamura Kosaburo, ...	Miye.
Kanno Susumi, ...	Hokkaido.
Nakagawa Minosuki, ...	Hokkaido.
Nakamura Morikazu, ...	Hokkaido.
Nakamura Riokichi, ...	Tokio.
Nakano Hidejiro, ...	Miye.
Ooka Chokichi, ...	Hokkaido.
Takabatake Yoshikadzu, ...	Kioto.
Ujiye Kichiroji, ...	Hokkaido.
Unayama Hachiya, ...	Awomori.
Yuyama Tomonori, ...	Hokkasdo.
Total, ... 14.	

PLAN OF ORGANIZATION.

I. OBJECT.

This College was founded by the Colonial Department of the Imperial Japanese Government, with a view to the education of young men for special service in the Department.

The number of Government Cadets is limited to fifty, and all their expenses, incurred in the College, will be defrayed by the Government.

The general course of instruction will extend over four years, after which successful graduates will serve in the Colonial Department for five years, as set forth in the "Agreement of Successful Candidate."

It is the aim of the College to qualify its students for intelligent and effective work in the administration of business, and in those departments of industry and science pertaining to agriculture and the development of natural resources, manufactures, and the maintenance of an advanced civilization; also to

promote conceptions of their relations to the state and to society, and of self-culture befitting their prospective stations, and the distinctive attributes of Man.

The following branches of knowledge are of leading importance in the course of instruction.

1.—Language and Literature, — English; Essays, Elocution and Debate.

2.—Book-keeping, and Forms of Business.

3.—Anatomy and Physiology, — Human Anatomy and Physiology; Physical Culture; Comparative Anatomy; Zoology.

4.—Mathematics and Engineering,—Algebra, Geometry, Trigonometry and Surveying; Drawing; Civil Engineering as applied to the Construction of Roads, Railroads, Bridges, and to works for Drainage, Water Supply and Irrigation.

5.—Mechanics, Physics, and Astronomy,—Theoretical and Applied Mechanics; Agricultural Machinery; Heat, Light, Electricity, Meteorology.

6.—Chemistry, Geology, and Mineralogy,—Theoretical and Practical, with particular reference to Agriculture, Metallurgy, and Chemical Manufactures.

7.—Botany and Horticulture,—Structural, Physiological and Systematic Botany; Microscopy; Fruit Culture; Landscape Gardening.

8.—Agriculture,—Theoretical and Practical. The various branches named above to be considered with constant reference to this subject.

9.—Mental and Moral Science, and Political Economy.

10.—Military Science and Tactics.

II. ADMISSION.

For admission to the Freshman Class, candidates must pass a satisfactory examination in the following subjects, viz :—

1.—Japanese and English Language, — Reading, writing, speaking and composition.

2.—Geography, — Eastern and Western Hemispheres.

3.—Arithmetic, — Elementary, including fractions, denominate numbers, proportion, percentage and its applications, involution and evolution, and analysis.

4.—Universal History,—Elementary.

5.—Algebra,—Through simple Equations.

Candidates for admission to an advanced standing will be examined as above, and also in the subjects of study passed over by the class which they may desire to enter.

Candidates must be not less than sixteen years of age, and must furnish satisfactory assurance that they are of sound constitution and good moral character.

Successful candidates must also sign the prescribed form of contract with the Government, and furnish a satisfactory surety, residing either in Tokio or Hokkaido.

The number of Governments Cadets to be admitted in the next Freshman Class is limited to eighteen. These will be selected by competition from the whole number of candidates examined. Applications for admission should be addressed to the Minister of the Colonial Department at Tokio, or to the Director of the College at Sapporo.

III. PRIVATE CADETS.

Other candidates, who pass a satisfactory examination, may enter as Private Cadets, without limitation of numbers.

In the case of Private Cadets, the obligation to serve five years under the Government after graduation is dispensed with, on condition that they pay the expense incurred on their account, — it being provided, however, that in no case shall such charges exceed twelve yens per month, each.

In all other respects Private Cadets are entitled to the same privileges, and subject to the same regulations, as are Government Cadets.

IV. FORMS OF APPLICATION AND AGREEMENTS.

APPLICATION FOR ADMISSION.

I respectfully ask to be received as a (Government or Private) Cadet in the Sapporo Agricultural College, provided I am able to pass a satisfactory examination.

Signature.....

Date.....

AGREEMENT OF SUCCESSFUL CANDIDATE.

Having been admitted as a Cadet to the Sapporo Agricultural College, I promise and agree as follows, namely :—

1.—*If I should be expelled from the College on account of any violation of the Laws of the Country or Institution, or if I should be dismissed on account of deficient scholarship, I will pay immediately to the treasurer there-*

of the cost of my education from the date of my admission to the time of my expulsion or dismissal; it being provided however that such charges shall not exceed twelve yens per month.

2.—*After graduation I will become a citizen of Hokkaido, and will serve in the Colonial Department for five years upon the same terms as other officers of similar rank. I also promise never to petition for a change of my citizenship.*

3.—*I will not offer my resignation as a cadet, or an officer, during the period specified in this agreement, even though sickness or other serious hinderance to my continuance should arise. If I should be compelled by unavoidable circumstances to ask for my discharge, I promise to pay to the treasurer my proportion of the whole expense of maintaining the College during my connection with it,— the total amount being divided by the number present with me.*

Signature.....

Date.....

Note. In the case of Private Cadets, paragraphs 2 and 3 are omitted.

AGREEMENT OF SURETY.

As surety for Cadet....., *if admitted to the Sapporo Agricultural College, I hereby promise and agree to become responsible for his faithful fulfilment of his agreement with the Colonial Department, and to pay promptly all his indebtedness to the treasurer of the College, in case of his failure so to do.*

Date..... *Signature*.....

ENDORSEMENT OF PROVINCIAL GOVERNOR.

The accompanying documents are correct, and the within named.....may be admitted to the College.

Date.....Signature.....

V. EXAMINATIONS OF RANK.

A register of the scholarship, deportment, and attendance of every student will be permanently kept.

The Professors shall keep a record of the term work of their classes, either daily or as shown by occasional examinations, estimated upon the scale of one hundred for perfect work. At the end of each term final examinations in writing will be held, to aid in determining the advancement of the students, and their relative rank in scholarship.

The average mark of each student in each subject will be determined by combining the mark obtained for term work with that obtained at the final examination, allowing equal weight to each.

The general average mark of each student, by which his relative rank will be fixed, will be determined by combining the marks obtained by him in his several studies, allowing to each a weight proportioned to the average number of exercises therein per week, during the term.

VI. DISMISSION.

If the general average mark of any student for any term is less than one-half the maximum, he shall be subject to discharge from the College; and only such as have been regular in attendance, and exemplary in

conduct will be allowed to go on with their respective classes.

Any student who may be dismissed on account of deficient scholarship or misconduct, or who may leave voluntarily before the expiration of the time stipulated in his contract, will be required to pay the cost of his education as specified in said contract, up to the date of his leaving. But no payment will be required in behalf of any student who may die, or who may be discharged on account of ill health, or without fault on his part.

Any student desiring temporary leave of absence on account of the sickness or death of a relative will be required to present an application from his parent or guardian, accompanied by a certificate from a physician and the chief magistrate of the town where the said relative resides.

VII. DIPLOMAS AND CERTIFICATES.

Every student who shall complete the studies of the General Course in a satisfactory manner will receive a Diploma awarding him the degree of Bachelor of Science, [Gakujiutsu Tokugiyoshi].

Any worthy student, who shall be obliged by circumstances beyond his control to relinquish his studies, may by vote of the Faculty, and with the approval of the Director, receive a certificate of his attainments, in any department of study in which he shall have won especial distinction.

VIII. PRIZES.

At the close of each collegiate year, Prizes to the

amount of one hundred and twenty-five dollars will be awarded to the most distinguished students in the several classes of the College.* The awards will be made by vote of the Faculty, so as to recognize and encourage improvement and excellence in all departments,—it being provided, however, that the sum of the awards made to any one student shall not exceed twenty dollars.

IX. ATTENDANCE AND DISCIPLINE.

College exercises will be held every day during term time, except Sundays and holidays. Wednesday afternoons will be regarded as time for recreation. Other afternoons will be devoted to field work, military drill, scientific excursions, or as may be ordered by the President with the approval of the Director.

Students must be regular in attendance upon all prescribed duties, and, if necessarily absent from any, must, as soon thereafter as practicable, render an excuse in writing to each officer from whose exercise they have been absent.

All cases of discipline, except such as relate to minor offences subject directly to the control of individual officers, shall be acted upon by the College Faculty,

* At the close of the last collegiate year (July 4th 1877), sixty dollars only were distributed in prizes, there being but one class of students to whom awards could be made. The prizes were as follows, viz:—

Department of	English Language,	8	and	4	dollars.
„	„ Mathematics,	8	„	4	„
„	„ Botany,	8	„	4	„
„	„ Chemistry,	8	„	4	„
„	„ Agriculture,	8	„	4	„

and their decision shall be approved by the Director before the infliction of punishment.

Students must be quiet and orderly in and around the college buildings, and behave everywhere with propriety.

Their quarters will be inspected at intervals, and strict order and neatness in the care of their rooms, their clothing and their own persons will be required.

Physical exercise, being absolutely essential to the preservation of health and mental vigor, is enjoined upon all. In addition to the field work, military drills, and excursions required in the course of training, suitable provision will be made for instruction in gymnastics during the winter season.

Students who may require medical care will be attended by a competent physician from the staff at the Government Hospital. Private cadets will be charged for medicines only.

X. FACULTY.

The members of the College Faculty shall meet for business at the call of the President, or shall hold stated sessions as they may deem necessary. They shall elect a Secretary, who shall keep a record of all their votes in a suitable book, and also a register of the marks of every student, as reported at the end of each term.

The President shall exercise a general supervision over all the affairs of the College; shall see that the duties of Professors, students and employes are properly assigned and performed; and, while consulting freely with the Faculty on questions of discipline and administration, shall have authority to veto their votes,

and act according to his own judgment, under the approval of the Director, whenever he may deem it necessary for the the best interests of the institution.

He shall prepare for publication an annual report upon the work of the college during the preceding year, and state the condition and progress of the several departments. The report shall also be accompanied by such useful papers as may be prepared by members of the Faculty, relating to observations, experiments and investigations in agriculture, or any branch of natural science.

Each Professor shall be responsible for the proper instruction and discipline of the classes under his charge, and shall perform such official duties as may be assigned him by the President. He shall also be responsible for the safe-keeping of the books, apparatus and specimens in his department, and for the economical use of all material furnished for experimental or practical purposes.

All requests for supplies, repairs and improvements shall be made to the Director through the President.

XI. GENERAL COURSE OF STUDY AND INSTRUCTION.

FRESHMAN YEAR.

First Term.

Algebra, including Logarithms, 6 hours each week.
Chemical Physics and Inorganic Chemistry, 6 hours.
English, 6 hours.
Agriculture, 2 hours.
Military Drill, 2 hours.
Manual Labor, 6 hours.

Second Term.

Geometry and Conic Sections, 6 hours each week.
Organic and Practical Chemistry, 8 hours.
Agriculture, 4 hours.
English and Elocution, 4 hours.
Free-hand and Geometrical Drawing, 3 hours.
Military Drill, 2 hours.
Manual Labor, 6 hours.

SOPHOMORE YEAR.

First Term.

Agricultural and Analytical Chemistry, 8 hours each week.
Agriculture, 4 hours.
Botany, 3 hours.
Human Anatomy and Physiology, 3 hours.
English and Elocution, 4 hours.
Military Drill, 2 hours.
Manual Labor, 6 hours.

Second Term.

Trigonometry and Surveying, 6 hours each week.
Quantititive and Analytical Chemistry, 8 hours.
Botany, 4 hours.
Agriculture, 2 hours.
Mathematical Drawing, and Plotting, 3 hours.
Military Drill, 2 hours.
Manual Labor, 3 hours.

JUNIOR YEAR.

First Term.

Topography, 3 hours each week.
Astronomy, 3 hours.

Botany, 3 hours.
Zoology, 3 hours.
Fruit Culture, 3 hours.
English, 4 hours.
Topographical Drawing, 3 hours.
Military Drill, 2 hours.
Manual Labor as required.

Second Term.

Mechanics, 6 hours each week.
Agriculture, 3 hours.
History of English Literature, 6 hours.
Landscape Gardening, 3 hours.
English Composition and Elocution, 2 hours.
Mechanical Drawing, 3 hours.
Military Drill, 2 hours.

SENIOR YEAR.

First Term.

Physics, 6 hours each week.
Veterinary Science and Practice, 6 hours.
Geology, 4 hours.
Book-keeping, 4 hours.
Microscopy, 3 hours.
Extempore Debate, 2 hours.
Military Drill, 2 hours.

Second Term.

Civil Engineering, 6 hours each week.
Mental and Moral Science, 6 hours.
Political Economy, 4 hours.
Original Declamation, 1 hour.
Military Drill, 2 hours.

REMARKS.

The foregoing schedule of exercises is to be followed as nearly as the circumstances of the College will allow. In cases of necessity studies may be transposed from one term to another, as the development of the institution may require.

The manner in which the several branches shall be taught will depend largely upon the ability and preference of the instructor. Oral and practical teaching will be largely pursued, though text-books will usually be employed in connection therewith.

The student will be required to take notes of lectures and of instruction imparted without a text book, and to carefully and neatly copy them into a suitable book. The note-books will be critically examined and corrected by the teacher.

Recitations, lectures, and laboratory work will usually be in the forenoon, beginning at half-past eight-o'clock. Drawing, military drill and manual labor will take place in the afternoon.

XII. PREPARATORY DEPARTMENT.

This Department is designed to prepare students for admission to the Sapporo Agricultural College, whose President will superintend the instruction of its classes.

The students will pay a fee of fifty cents per month, for the use of books, and for tuition; but they will not be provided with board and clothing.

The regular course of study extends over three years.

Applicants for admission should be not less than twelve years of age, and well taught in the elements of Japanese learning. They should also be able to

read and write the characters of the Roman alphabet, and the Arabic figures, and should understand their simpler combinations.

The scholarship and rank of Preparatory students will be determined as is specified iu the case of members of the College. When after due trial it appears that any student is unable to pursue the studies of his class with advantage, he may be transferred to a suitable class or discharged, at the discretion of the President, with the approval of the Director.

Prizes to the amount of twenty-five dollars will be awarded to the most worthy students in the several classes, at the close of each academic year.

The calendr will be the same as that of the College.

XIII. PREPARATORY COURSE OF INSTRUCTION.

FIRST YEAR: THIRD CLASS.

First Term.

English Language, 6 hours each week; correct and distinct pronunciation of elementary sounds; names of common things; simple sentences and colloquial phrases.

Reading, Spelling and Definitions, 6 hours.

Mental Arithmetic, 6 hours; every student to have, also, a slate or paper and pencil.

Writing, 3 hours; special attention to be given to the proper mode of holding the pen, the position of the body, and neatness of the book.

Japanese and Chinese, 3 hours.

Second Term.

English Language, 6 hours each week; construction of sentences; distinct utterance and correct pronunciation.

Reading, Spelling and Definitions, 6 hours.
Arithmetic, 6 hours; mental and written exercises.
Writing, 3 hours.
Japanese and Chinese, 3 hours.

SECOND YEAR: SECOND CLASS.

First Term.

English Language, 6 hours each week; exercises in conversation and recitation; elements of English Grammar without a text book.
Reading, Spelling, Definitions and Dictation, 6 hours; written exercises carefully corrected by the teacher.
Geography, 6 hours; oral instruction with globe and wall maps; afterward, text book.
Writing, 3 hours.
Japanese and Chinese 3 hours.

Second Term.

English Language, 6 hours each week; oral lessons, with examinations; compositions on topics discussed, written in the recitation room, and sometimes more carefully prepared.
Reading, Spelling and Analysis of Sentences, 6 hours.
Geography, 6 hours.
Writing, 3 hours.
Japanese and Chinese, 3 hours.

THIRD YEAR: FIRST CLASS.

First Term.

English Grammar, 6 hours each week.
Practical Arithmetic, 6 hours.
Universal History, 6 hours.
Reading, Composition and Writing, 3 hours; practice in letter-writing; productions to be critically

examined and corrected by the teacher, and recopied by the student into a suitable book.

Japanese and Chinese, 3 hours.

Second Term.

Arithmetic and Algebra, 6 hours each week; Arithmetic completed; Algebra through simple equations.

History of Civilization, 6 hours.

Reading, Elocution, and Composition, 6 hours.

Japanese and Chinese, 6 hours.

XIV. LIBRARY AND READING ROOM.

The College Library contains, in the Foreign Department, 3734 volumes, of which 3311 are in the English language, and 423 in other western tongues. In the Japanese and Chinese department, there are about 1500 volumes. These consist chiefly of books of reference, and text books for use in the course of instruction.

A list of the additions made since the publication of the First Annual Report will be found elsewhere. Important additions will be made during the following year.

REGULATIONS.

1.—The books in the College Library are intended, primarily, for the use of the Officers and Students of the College.

2.—The text books required for the several classes are issued for the term, and they must be returned after the final examinations in the subjects of which they treat.

3.—Text books excepted, teachers will be allowed to have in their possession not more than four volumes, and students one volume each, at one time. They must be returned within four weeks of the date of their issuance in every case. Any book may be once reissued to the same person for four weeks only, provided no application shall have been made for it while in his possession.

4.—Officers of the Colonial Department may take out books upon the same terms as students.

5.—No book shall be taken from the Library without the knowledge and presence of the Librarian, or his representative.

6.—Every book given out must be entered under the name of the taker in the Librarian's register, and must be checked off on its return,—the date being noted in both cases.

7.—For books lost or injured, those to whom they shall be then charged will be held responsible.

The College Reading Room was first opened at the begining of the current academic year. Racks, tables, and seats were provided, and files of about twenty different foreign periodicals, and one native publication have been gratuitously supplied by the officers and friends of the College.

The room is open for the use of officers and students from 8.00 A. M. to sunset.

Provision has been made by the College for adding to the list of periodicals, and, with the continued assistance of friends at home and abroad, it is to be hoped its value will be materially increased.

XV. APPARATUS, CABINETS, COLLECTIONS, &c.

In the Department of Mathematics, Physics and Engineering, complete furnishings for the drawing-office, and an outfit of surveying and engineering instruments have been procured. Arrangements have been made to obtain, during the following year, additional apparatus and instruments for this department, namely :—

A complete equipment of physical apparatus, for the illustration of lectures, and for laboratory practice.

A collection of engineering, mechanical, and agricultural machine models,—working and illustrative.

An astronomical transit-theodolite, adapted also for geodetic surveying.

The Chemical Laboratory is well furnished throughout with all the requirements of apparatus and sup plies for thorough instruction in general chemistry, and for practical work in qualitative and quantitative analysis, both in inorganic and organic chemistry.

The mineral cabinet attached contains about twelve hundred specimens.

The College Farm and Botanic Gardens are well furnished for the practical instruction of the students in general farming and horticulture, and are designed to afford models of good management in rural economy.

The formation of a College Museum comprising zoological and industrial cabinets has already been undertaken. These cabinets will contain collections representing the Natural History of Hokkaido, and will include, also, such specimens from abroad as may be obtained by purpose or exchange.

The sum of four hundred dollars will be applied annually to this purpose.

The Military Department will be organized and equipped upon the opening of the next collegiate year.

XVI. CALENDAR.

The collegiate year begins on the fourth Thursday of August, and closes on the first Wednesday of July.

It is divided into two terms, the first continuing from the fourth Thursday of August to the fourth Wednesday of December inclusive, and the second from the fourth Thursday of January to the first Wednesday of July.

The Calendar for the next Collegiate year is as follows :—

1878—9.

1878.—August 22, First term begins.
August 22,23. Examinations at Sapporo for Admission. *
September 17. Holiday ; Festival of Kanname.
November 3. Holiday ; Birthday of Emperor.
November 11. Holiday ; Festival of Niiname.
December 23,24,25. Class Examinations.
December 25. First term ends.
1879.—January 23. Second term begins.
January 30. Holiday; Death of Komei Tenno.
February 11. Holiday; Accession of Jimmu Tenno.
April 3. Holiday ; Death of Jimmu Tenno.
June 15. Holiday ; Sapporo Festival.

* Applicants living in Tokio and vicinity will be examined at Tokio by an officer of the College, or by some resident foreign teacher duly authorized to grant certificates of qualification in scholarship.

June 30, July 1,2. Class Examinations.
July 2. Second term ends.
August 28. First term, 1879—80, begins.

ABSTRACT

OF

FINAL EXAMINATION EXERCISES. QUESTIONS AND TOPICS FOR WRITTEN EXAMINATIONS.

I. SECOND TERM, 1876—7.

FRESHMAN CLASS.

PHYSIOLOGY.

1.—Human Body,—its chemical composition.
2.—Fluids of the system.
3.—Primary and compound tissues.
4.—Bone,—composition and structure.
5.—Teeth.
6.—Evidences that man was designed to be omnivorous.
7.—Circulation of the blood,—causes and rapidity.
8.—Mode and objects of respiration.
9.—Hair,—structure and functions.
10.—Brain and nervous system.
11.—Ear,—structure.
12.—Evidences of the existence of one intelligent, benevolent God.

W. S. Clark.

GEOMETRY.

1.—Define a straight line; a plane; and a circle. Give a test for ascertaining whether a surface be plane or not.

2.—In any right triangle, the equilateral triangle described on the hypotenuse is equal to the sum of the equilateral triangles described on the sides.

3.—For what other figures besides equilateral triangles is the above theorem true?

4.—If from the center of a circle a line be drawn to any point in the chord of an arc, the square of that line, together with the rectangle of the segments of the chord, will be equal to the square of the radius.

5.—The sums of the opposite sides of a quadrilateral circumscribing a circle are equal.

6.—The sum of two opposite angles of an inscribed quadrilateral is equal to two right angles.

7.—Two parallel chords are respectively 60 and 96 feet, and the distance between them 26 feet. What is the diameter of the circle?

8.—An angle of 20° included between two radii stands upon arc whose length is 500 shaku. What is the radius of the circle?

9.—Give a formula for the solidity of a sphere. How is it derived?

10.—Give and demonstrate an original proposition, corollary, or scholium, or give an original demonstration of any found in the text-books.

Wm. Wheeler.

PHYSIOLOGICAL BOTANY.

1.—Define reproduction, and state how many kinds occur, with examples.

2.—What distinguishes Phenogams from Cryptogams?

3.—State the essential organs of Phenogams, and their specific functions.

4.—Where and how is pollen formed, and what is its nature morphologically ?

5.—What is the cause of waxy pollen, as in Orchidaceæ ?

6.—What are the essential organs of Cryptogams, and their specific functions ?

7.—Give the reproduction of Filices.

8.—How many kinds of reproduction are noticed in Algæ ?

9.—Give the general characteristics of Algæ, and state how they differ from Lycopodiaceæ.

10.—What, in general, characterize the plants of the lower orders of Cryptogams ?

D. P. Penhallow.

CHEMISTRY.

1.—What are heavy metals,—some of their characteristics and uses ?

2.—Give the properties of Arsenic, and the methods of detection.

3.—What are the Noble Metals, and their characteristics ?

4.—State, in general terms, the principles of photography, and the methods of producing a sensitive plate.

5.—What is Organic Chemistry, and how distinguished from Inorganic ?

6.—Define decay, and fermentation.

7.—What substances are essential to acetous fermentation, and what are the resulting products ?

8.—Alcohol.

9.—Give the general chemical composition of plants, and their proximate principles.

10.—Oils and fats.

D. P. Penhallow.

II. FIRST TERM, 1877—8.

SOPHOMORE CLASS. CONIC SECTIONS.

ELLIPSE.

1.—The axes of an ellipse are 10 and 8. What is its eccentricity?

2.—What is the latus rectum of the same?

3.—What the area?

4.—Give the equation of the ellipse referred to its center and axis, and state how it is derived.

5.—A = 10; B = 6; $x = 5$. Find the value of the ordinate y.

6.—An ordinate to the major axis is 7, and the corresponding abscisses are 5 and 20. What is the minor axis?

7.—If a cone be cut by a plane making an angle with the base less than that made by an element of the cone, the section is an ellipse.

PARABOLA.

1.—The diameter of a circle, whose circumference passes through the vertex and the extremities of the latus rectum, is equal to five times the distance from the focus to the vertex.

2.—If a tangent be drawn, making the distance from the focus to the point of tangency equal to the normal at the same point, the line from the focus to the point of tangency is equal to the latus rectum.

3.—Any tangent to a parabola meets the directrix and latus rectum produced in points, equally distant from the focus.

4.—What is the equation of the parabola referred to its principal vertex as an origin, and how is it derived?

5.—An ordinate to a diameter is 12 inches, and the corresponding abscissa is 5 inches. Required the parameter of that diameter.

6.—The latus rectum of a parabola is 16 inches. What is the area of the segment cut off by a double ordinate to the axis, whose corresponding abscissa is 25 inches?

7.—A mortar is placed at angle of 30° with the horizon, its muzzle at the level surface of the earth. A shell is discharged at an initial velocity of 1000 feet per second. Disregarding atmospheric resistance, and allowing 16 feet to be the distance which a body falls in one second from as tate of rest; (a), What would be the height of the projectile above the earth at the end of 4 seconds? (b), At what distance from the mortar would it fall? (c), What would be the greatest height attained by it?

8.—If a cone be cut by a plane parallel to one of its elements, the section will be a parabola.

Wm. Wheeler.

TRIGONOMETRY.

1.—Compute the natural sine of 3′.

2.—Given, sin. 20° = . 34202. Find cosine.

3.—Right triangle. Given A and *c*. C = 90°. Solve.

4. „ „ „ *a* and *c*. C = 90°. „

5. „ „ „ a and b. C$=90°$. Solve.
6.—Oblique triangle. Given A, B, and a. „
7. „ „ „ a, b, and C. „
8. „ „ „ B, b, and $(a+c)$. „
9. „ „ „ a, b, and A. „
10. „ „ „ a, b, and c. „

11.—From a station, B, at the base of a mountain, its summit, A, is seen at an elevation of 60°; after walking one mile toward the summit, up a plane making an angle of 30° with the horizon, to another station, C, the angle BCA, is observed to be 135°. Find the height of the mountain in yards.

12.—From a window in the same horizontal plane with the bottom of a steeple, the angle of elevation of the top of the steeple is 40°; and from another window, 18 feet directly above the former, the angle of elevation is 37° 30′. Find the height and distance of the steeple.

Wm. Wheeler.

PRACTICAL CHEMISTRY.

Analysis of given compound * by the humid method. Metals also to be determined by blowpipe.

Written Examination.

1.—Methods of analysis.
2.—State tests in blowpipe analysis, and why employed.
3.—Classification of elements for analysis, and the basis of such arrangement.

* The compound, different for each student, contained nine acids and bases. Report to contain methods of solution and analysis employed, and acids and bases found.

4.—Methods of solution.

5.—Given in mixture, oxides of Lead, Copper, Manganese, and Aluminium: how proved before the blowpipe?

6.—Given in mixture, oxides of mercury, (Hg_2 O, Hg O), Arsenicum and Potassium, and Ammonia: separate and prove each by humid method.

7.—Given in mixture, oxides of Bismuth, Antimony, Iron, (Fe_2 O_3), and Barium: separate and prove each by humid method.

D. P. Penhallow.

AGRICULTURE.

1.—Carbonic Acid Gas—Its Relations to Vegetation.

2.—Ozone—Its Relations to Vegetable Nutrition.

3.—Diseases of Plants Caused by Atmospheric Influences.

4.—Principles upon Which Crop Rotation Depends.

5.—Sulphate of Lime—Its Value and Manner of Action as Manure.

6.—Phosphate of Lime — Its Value as Manure. Method of Manufacture of Superphosphate.

7.—Value of Animal Excrements as Affected by Age, Condition, Work and Food of Animals.

8.—Farm Economy — Importance of System — Economy with Regard to Labor.

9.—Advantages of Special Farming.

10.—Principles which Should Guide in the Selection of a Farm for General Farming.

W. P. Brooks.

FRESHMAN CLASS.

ALGEBRA.

1.—Multiply $x^m - x^m - {}^1y + x^{m-2}y^2 - y^m$, *by* $x+y$.

2.—Give analysis of Reciprocals, Zero Powers, and Negative Exponents.

3.—Find the factors for $x^5 - y^5$.

4.—What sum of money put at simple interest will amount to $ 1488 in 8 months, and $ 1530 in 15 months?

5.—Divide the number a into two parts which shall have to each other the ratio of m to n.

6.—If the length of a field be 12 rods, and the breadth 8 rods, what quantity must be added to its breadth that the contents may be 60 square rods? Interpret the result.

7.—Simplify $(a^{-\frac{1}{2}} a^{\frac{3}{4}})^{\frac{3}{2}}$.

8.—Divide $1+\sqrt{-1}$ *by* $1-\sqrt{-1}$.

9.—Given $x^{2n} - 2x^n = 8$, to find the value of x.

10.—Two cubical blocks of stone, placed one upon the other, form a monument 16 feet high, containing 1072 cubic feet. What are the lengths of their edges?

11.—Find the geometrical mean between $2a^2 b^{\frac{1}{2}}$, and $24 a^3 b^{\frac{1}{2}} x^{\frac{1}{2}}$.

12.—Find the sum of n terms of the progression 1, 3, 5, 7, ...,

13.—The sum of four numbers in geometrical progression is 85; and the sum of the first two is to the sum of the other two, as 1 is to 16. What are the numbers?

14.—If shot be piled in the form of a pyramid with a square base, each side of which exhibits 25 shot, what is the number contained in the pile?

15.—Given $\frac{ab^x - c}{d} = m$, to find the value of x.

Wm. Wheeler.

CHEMICAL PHYSICS AND INORGANIC CHEMISTRY.

1.—Define force, and state the kinds.
2.—Define gravity and state the principles of measurement.
3.—Molecular forces, and their action upon matter
4.—Heat, and the principles of measurement.
5.—Light; its source and propagation.
6.—Dispersion of Light, and the laws governing the same.
7.—Spectrum.
8.—Electricity.
9.—What relations do the physical forces bear to Chemistry? Examples.
10.—Chemical Philosophy.
11.—State the law governing the combination of elements, with examples.
12.—Define an acid, base, alkali, salt, and halogen.
13.—Hydrogen.
14.—Oxygen.
15.—Oxydation. Examples.

D. P. Penhallow.

AGRICULTURE.

1.—Define Agriculture—Its Importance as an Occupation.
2.—The Importance to a Farmer of a Knowledge of Chemistry,—Botany — Entomology — Veterinary Medicine—Enumerate the other Branches

of Knowledge which it is Important for Them to Know.

2.—Define Soil, Surface Soil or Tilth, Subsoil—Hard-pan.

4.—Enumerate the Agents which have been Chiefly Instrumental in the Pulverization of Rocks, and Describe the Mode of Action of Glaciers.

5.—Influence of Organic on Inorganic Matter in the Soil.

6.—Enumerate the Different Classes of Soils as to Their Place of Origin; and State the Characteristics of Each Class, and how Each may have been Formed.

7.—Absorption of Vapor of Water by Soils.

8.—Power of Soils to Remove Dissolved Solids from Their Solutions.

9.—Sources from which the Surface Soil Derives its Heat. Influence of Color on the Power of Soils to Absorb Heat, and the Influence of Texture on Their Power to Retain Heat.

10.—Crop Adaptation of Sandy Soil—of Alluvial Soil.

W. P. Brooks.

the summer. This is the evident consequence of the configuration and relative position of the sea and land, —the warmth of the ocean during the cold season inducing the currents from the land of Asia on the north-west, and the higher temperature of the latter in the heat of summer inciting a reversion of the prevailing currents at that time. The total resultant of the winds for the year was equivalent to a movement through 7770 miles, from a direction 22° 30′ east of south, or exactly south-south-east.

Consulting the register of the Imperial Meteorological Observatory at Tokio for 1876, I find that the prevailing winds at the same seasons, respectively, are approximately north-by-west and south-by-east, —the position of the mass of the island of Hondo on the north, and the warmer ocean currents being more nearly south, partially accounting for the difference noted.

The period of time and the limited area covered by reliable observations which are now available,—September 1876 to December 1877, at Sapporo, and the whole of 1876 at Tokio,—are, of course, insufficient to determine conclusively the laws governing the entire movement of the storms along the eastern Asiatic Coast.

Observations of the storms at Sapporo, which appeared to have been widely extended, have however presented indications corresponding almost invariably o a general movement from the south-west toward the north-east, passing off apparently in the direction of the Kurile islands. The revolution of the storms about their centers is from right to left as they progress, or contrary to the movement of the hands of a watch. In the midst of the storms, the "eye," so

FR

NAME.	RANK.	GENERAL AVERAGE.	AGRICULTURE Weigh
Arakawa Shigehide.	1	85.2	88.1
Oshima Masatate.	2	85.0	81.5
Sato Shosuke.	3	80.6	82.4
Kuroiwa Yomonoshin.	4	76.9	74.2
Tanouchi Suteroku.	5	71.9	79.1
Uchida Kiyoshi.	6	70.9	79.8
Ono Kanemoto.	7	69.3	66.7
Ideta Seitaro.	8	68.0	75.3
Sato Isami.	9	67.5	73.9
Yamada Yoshihiro.	10	66.0	74.6
Ito Kadzutaka.	11	65.8	72.7
Yasuda Nagaaki.	12	62.9	62.5
Watase Torajiro.	13	62.6	63.5
Nakashima Shinshi.	14	56.9	62.7
Ono Takuma.	15	51.4	58.1
Yanagimoto Michiyoshi.	16	51.3	59.7

the direction of the two opposite currents prevailing at each place, respectively. In the conflict of these opposing currents, and the added influence of the earth's rotation, are evidently the immediate causes of the rotary and progressive movements observed.

Farther investigation of the laws and movements of storms is urgently commended to all future observers here and elsewhere in the Empire, as the extension of data for comparison shall allow.

The establishment of fifteen or twenty well equipped stations at favorable points throughout the Empire, connected by telegraph with a central station, would soon enable reliable predictions to be published at all important shipping ports having telegraphic communication, in advance of threatening weather. In view of the fact that about three hundred Japanese vessels are lost annually in stormy seas, the expense attending such an undertaking would be trivial, weighed in the balance against the saving of life and property, and the exercise of a nation's humanity. A few connected stations along the coast of China and Corea would greatly increase the extent and efficiency of the system.

The order of the Colonial Department for the establishment of three additional stations in Hokkaido,—at Hakodate, Nemuro, and Rumoye,—to be conducted uniformly with the system pursued at Sapporo, is a step in the right direction. Three young men have been receiving instruction since November last preparatory to assuming the duties of observers at these proposed stations.

I am indebted to Professors Penhallow and Brooks, and to Mr. Yamada Masakuni for valuable assistance in taking observations during several occasions of my

enforced absence upon other duties.

EXPLANATION OF THE TABLES.

Observations are taken three times daily, at 7 A. M., 2 P. M., and 9 P. M., in accordance, mainly, with the standard system of the Smithsonian Institution, Washington, United States of America. The following data are thereby determined:—

1.—*Temperature in the Open Air.*—Stated in degrees according to the scale of Fahrenheit's thermometer. The maximum and minimum temperatures for each day are also determined by self-recording thermometers.

2.—*Pressure of the Atmosphere.*—Determined by a mercurial barometer. The height of the mercury column is stated in inches, and is reduced to that which would occur if the mercury was at 32° Fahrenheit.

3.—*Pressure of Aqueous Vapor.*—Obtained from readings of the wet and dry-bulb hygrometer, by means of tables based on experiment. Under this head are entered the numbers which indicate the inches of mercury in a barometer which the moisture of the atmosphere alone will sustain,—the whole pressure of the atmosphere, as given under the head of "Barometer" being due, conjointly, to the weight of the air, and of the moisture which it contains.

4.—*Relative Humidity of the Atmosphere.*—Determined from observations of the wet and dry-bulb hygrometer. This is expressed by the percentage which the amount of moistures actually present in the air, bears to the amount which the air would contain at saturation.

5.—*Time and Amount of Rain and Snow.*—Under this head are entered the time of beginning and end-

ing of the fall of rain or snow, and the amount, in inches, of rain or melted snow collected in a gauge at the surface of the ground; also the depth of the snow in inches.

6.—*Direction of Wind.*—Representing the direction from which the wind is blowing, as indicated by a vane. The direction is entered in sixteen points of the compass.

7.—*Velocity and Progress of Wind.*—Ascertained by Robinson's anemometer,—showing respectively the rate of movement in miles per hour, and the entire progress of the wind during the intervals between the successive observations.

8.—*Amount of Cloudiness.*—Determined by estimation, and designated by figures representing the percentage of sky obscured at each observation.

9.—*Forms of Clouds.*—These are classified somewhat arbitrarily as follows:—Cirrus (C.), consisting of slender filaments, either parallel or divergent, having the greatest altitude, the least apparent density, and the greatest variety of form. The cirri are often composed of snow or ice crystals, and it is among these clouds that halos and parhelia are formed. *Cumulus* (Cu.), consisting of large white rounded masses, rising either from an irregular or horizontal base. The cumuli are formed by the condensation of moisture in ascending currents of air. Their height varies greatly, but is always less than that of the cirri. *Stratus* (S.), composed of continuous horizontal sheets or layers, formed in the lower atmosphere, usually at about sunset and durirg the night. *Nimbus* (N.), is applied to clouds from which rain or snow is falling. The primary forms of rain clouds are frequently either cumulus or stratus. Intermediate varieties, or

combinations of the foregoing are indicated thus:—*Cirro-cumulus* (C-cu.); *Cirro-stratus* (C-s.); *Cumulo-stratus* (Cu-s); and *Cirro-cumulo-stratus* (C-cu-s.).

Observations of casual phenomena, such as lightning, rainbows, halos, earthquakes, early and late frosts, depth of ground frozen, extraordinary fluctuations at irregular hours, etc., are also recorded.

MEMORANDA.

The "Certificates of Examination" of the instruments in use were not received until after the Register for 1877 was nearly completed. The corrections therein noted are therefore inserted here. The general results will not be materially affected thereby.

"Corrections to be applied to the scale readings, determined by comparison with the standard instruments at the Kew Observatory";—

1.—Barometer by Casella, London. Standard No. 748.

Correction, (including capillary action)=+0.002 inch.

Corrections to Attached Thermometer, No. 17129.

At 32	At 42°	At 52°	At 62	At 72°	At 82°	At 92°
0.0	0.0	—0.1	—0.3	—0.2	—0.4	—0.4

2. Thermometers, by Casella, London.

Instrument.	At 32°	At 42°	At 52°	At 62°	At 72°	At 82°	At 92°
Standard, No. 20940,	0.0	+0.1	+0.1	0.0	0.0	0.0	+0.1
Maximum, No. 20888	+0.1	0.0	—0.1	—0.1	—0.1	0.0	+0.1
Minimum, No. 20906	0.0	+0.1	+0.1	0.0	0.0	——	——
Dry Bulb, No. 12286	—0.1	—0.1	—0.2	—0.1	—0.1	—0.2	—0.2
Wet Bulb, No. 12287.	—0.1	—0.2	—0.2	—0.1	—0.1	—0.2	—0.2

The Thermometers are placed in an observatory upon the roof of the Kiu Honjin at an elevation of 24.50 feet above the surface of the ground. This observatory is thermally insulated from the open hall of the house by two trap-doors situated about ten feet apart, between which the air has free access from without through an entirely open dormer-window. The sides of the observatory are fitted throughout with blind slats, and a door of the same form is in each side. These are kept open, except during stormy weather.

CE OF OBSERVATION, KIU HONJIN
56″ N. LONGITUDE, 141° 22′ 49″ E

Day of Month.	NEMOMETER.					CLO			
		Progress of Wind.				Per cent. of Cloudiness.			
	7 A. M.	7 A. M. 10 hours.	2 P. M. 7 hours.	9 P. M. 7 hours.	Whole Day.	7 A. M.	2 P. M.	9 P. M.	Means.
1	32	151	96	71	318	100	97	80	92.3
2	35	113	10	18	141	50	99	80	76.3
3	35	3	7	11	21	75	95	100	90.0
4	32	10	8	4	22	80	70	10	53.3
5	27	24	26	35	85	40	90	50	60.0
6	26	30	31	28	89	20	50	100	56.7
7	29	14	75	123	212	99	100	40	79.7
8	25	131	73	42	246	99	60	100	86.3
9	33	58	31	15	104	100	100	100	100.0
10	32	8	5	17	30	100	55	2	52.3
11	31	76	57	30	163	100	100	60	86.7
12	32	44	21	5	70	65	100	3	56.0
13	20	23	44	23	90	3	70	5	26.0
14	6	67	85	65	217	70	25	5	33.3
15	23	90	73	25	188	100	95	100	98.3
16	20	45	40	51	136	90	85	95	90.0
17	13	66	27	16	109	98	50	75	74.3
18	27	12	15	30	57	12	15	90	39.0
19	22	93	70	22	185	100	100	100	100.0
20	35	120	98	108	326	75	75	100	83.3
21	34	104	87	94	285	90	99	98	95.7
22	24	70	79	87	236	99	100	100	99.7
23	25	56	51	40	147	95	20	15	43.3
24	23	41	52	110	203	5	25	100	43.3
25	10	213	124	85	422	100	70	10	60.0
26	32	33	37	52	122	25	50	100	58.3
27	27	20	21	26	67	90	75	100	88.3
28	24	9	28	17	54	98	95	70	87.7
29	24	23	35	35	93	75	75	95	81.7
30	27	11	82	57	150	50	75	60	61.7
31	25								
Means.	26.	58.29	51.32	47.13	156.74	73.64	74.03	69.13	72.26
Maxima.	35	213	124	123	432	100	100	100	100.0
Minima.	6	3	5	4	21	3	15	2	26.0
				Total.	4859				

J, SAPPORO JAPAN.
L. TIDAL ELEVATION, 75 FEET.

UDS.

Kind of Clouds.			Day of Month.	REMARKS.
7 A. M.	2 P.M.	9 P. M.		
S.	C-cu-s.	N.	1	
N.	N.	N.&C-cu.	2	
S.	S.	N. & S.	3	
S.	N & Cu-s.	N.	4	
N & C-s.	S.	S.	5	
S.	C-s.	N.	6	
S.	Cu-s.	S.	7	Lighting and thunder, Night, A. M.
S.	N.	N. & S.	8	
S.	N. & C.	N.	9	
S.	S.	S.	10	
S.	Cu-s.	Cu.	11	
N.	N.	N & C.	12	
N. & C.	N.	S.	13	
S.	S.	S.	14	
N.	C-s.	S.	15	
N. & S.	Cu-s.	N.	16	
C-s.	C-s.	C-s.	17	
C-s.	C-s.	S.	18	
Cu.	C-s.	N. & S.	19	
N. & S.	N.	N.	20	
N.	N. & Cu.	N.	21	
N. & S.	N. & S.	N. & S.	22	
S.	N. & Cu-s.	S.	23	
S.	C.	C.	24	
C-s.	C-s.	S.	25	
N.	N & Cu-s.	C-cu.	26	Rainbow, 2 P. M.
Cu-s.	Cu-s.	S.	27	
S.	Cu-s.	S.	28	
N. & S.	N. & Cu-s.	S.	29	
S.	N. & S.	N. & S.	30	Depth of snow in fields, 18 ins.
N. & S.	N & Cu.	N & C-s.	31	Depth of frozen ground, 0 ins.
			Means.	
			Maxima.	
			Minima.	

ACE OF OBSERVATION, KIU HONJ
8′ 56″ N. LONGITUDE, 141° 22′ 49″

Day of Month.	7	ANEMOMETER. 9 P. M.	Progress of Wind. 7 A. M. 10 hours.	2 P. M. 7 hours.	9 P. M. 7 hours.	Whole Day.	Per cent. of Cloudness. 7 A. M.	2 P. M.	9 P. M.	M
1	2	7.4	28	17	49	94	60	100	100	8
2	2	1.8	71	89	91	251	100	100	96	9
3	2	1.7	96	74	29	199	99	100	30	7
4	2	0.4	24	17	2	43	99	99	100	9
5	2	0.4	13	10	11	34	10	85	2	3
6	1	2.0	12	9	7	28	15	5	30	1
7	3	1.9	61	75	40	176	100	95	100	9
8	2	2.9	8	59	62	129	75	98	100	9
9	2	0.5	54	45	26	125	100	60	0	5
10	1	0.4	9	9	14	32	15	30	5	1
11	1	2.4	38	18	55	111	2	5	80	2
12	1	7.9	16	32	52	100	50	50	100	6
13	2	3.4	98	71	51	220	90	15	3	3
14	1	12.0	24	52	99	175	20	50	70	4
15	2	21.6	80	70	90	240	100	100	80	9
16	3	12.0	175	100	120	377	100	50	90	8
17	2	0.7	98	32	41	171	95	30	75	6
18	2	10.2	32	18	63	113	10	75	100	6
19	2	20.4	81	55	138	274	10	20	100	4
20	2	14.4	145	140	120	405	100	50	50	6
21	1	2.4	38	13	15	66	25	40	10	2
22	1	7.2	16	18	23	57	50	1	3	1
23	3	21.6	63	67	102	232	30	98	100	7
24	3	0.7	107	73	38	218	100	100	30	7
25	2	5.4	18	34	42	94	25	25	85	4
26	2	7.2	32	35	36	103	85	75	25	6
27	3	2.4	112	73	39	224	90	100	100	9
28	2	12.0	29	95	142	266	80	25	30	4
Means.	23	6.55	56.36	50.00	56.39	162.75	61.96	60.04	60.50	6(
Maxima.	3	21.6	175	140	142	405	100	100	100	9
Minima.	1	.40	8	9	2	28	2	1	0	1(
					Total.	4557				

IN, SAPPORO, JAPAN.
E. TIDAL ELEVATION, 75 FEET.

Clouds.					
	Kind of Clouds.			Day of Month.	REMARKS.
EANS.	7 A. M.	2 P. M.	9 P. M.		
6.7	N.&C-s.	N.	N.	1	
8.7	N.	N.	N. & S.	2	
6.3	N. & S.	N.	S.	3	
9.3	S.	S.	S.	4	
2.3	S.	Cu-s.	S.	5	
6.7	S.	C-s.	S.	6	
8.3	N.	N. & S.	S.	7	
1.0	S.	N. & S.	S.	8	
3.3	N. & S.	Cu-s.	—	9	
6.7	S.	Cu.	S.	10	
9.0	S.	Cu-s.	S.	11	
6.7	N. & S.	Cu-s.	N.	12	
6.0	N.	Cu-s.	S.	13	
6.7	C-s.	C-cu-s.	N.	14	
3.3	N.	N.&Cu-s.	N.	15	
0.0	N.	N.&Cu.	N.	16	
6.7	N.&C-s.	Cu.	N. & S.	17	
1.7	C-s.	Cu-s.	S.	18	
3.3	Cu-s.	C-cu-s.	N.	19	
6.7	N.	N.&Cu.	C-s.	20	
5.0	S.	C-cu-s.	C-s.	21	
8.0	S.&Haze.	C-s.	S.	22	
6.0	S.	N.&Cu-s.	N.	23	
6.7	N. & S.	N. & S.	S.	24	
5.0	C-cu-s.	C-cu-s.	S.	25	
1.7	C-s.	Cu-s.	C-s.	26	Lunar halo, 9 P. M.
6.7	C-cu-s.	S.	N.	27	
5.0	N.&Cu-s.	C-cu-s.	S.	28	Depth of snow in fields, 36 ins. Depth of frozen ground, 0 ins.
0.84				Means.	
9.3				Maxima.	
3.7				Minima.	

CE OF OBSERVATION, KIU HONJIN
56″ N. LONGITUDE, 141° 22′ 49″ E.

Day of Month.	7 A.	NEMOMETER. Progress of Wind. 7 A. M. 10 hours.	2 P. M. 7 hours.	9 P. M. 7 hours.	Whole Day.	CLO Per cent. of Cloudiness. 7 A. M.	2 P. M.	9 P. M.	Means.
1	30	153	158	194	505	100	98	100	99.3
2	29	81	72	57	210	25	25	60	36.7
3	22	17	33	56	106	60	45	10	38.3
4	29	49	61	23	133	75	30	75	60.0
5	26	49	43	68	160	25	2	50	25.7
6	21	30	53	118	201	75	90	60	75.0
7	34	129	173	157	459	100	100	25	75.0
8	32	165	105	70	340	15	25	5	15.0
9	26	37	26	15	78	100	100	100	100.0
10	51	14	48	12	74	90	95	100	95.0
11	32	5	87	93	185	85	30	10	41.7
12	26	67	17	30	114	99	60	35	64.7
13	33	88	52	80	220	98	98	75	90.3
14	32	88	18	7	113	100	99	75	91.3
15	28	22	26	14	62	10	80	10	33.3
16	30	34	52	50	136	98	25	5	42.7
17	30	24	31	31	86	15	15	5	11.7
18	34	50	39	29	118	5	30	0	11.7
19	37	52	71	58	181	95	15	20	43.3
20	30	29	81	85	195	5	5	5	5.0
21	33	149	131	130	410	75	60	100	78.3
22	34	44	41	22	107	100	30	95	75.0
23	34	59	29	69	157	100	80	20	66.7
24	34	44	67	45	156	75	95	100	90.0
25	33	11	44	70	125	95	95	80	90.0
26	31	35	41	20	96	60	100	100	86.7
27	33	191	94	83	368	100	100	100	100.0
28	33	72	33	39	144	30	90	100	73.3
29	31	26	97	33	156	40	100	70	70.0
30	34	71	63	48	182	95	90	50	78.3
31	27	7	43	74	124	100	60	95	85.0
Means.	30.8	61.03	62.23	60.65	183.90	69.19	63.45	55.97	62.87
Maxima.	37.	191	173	194	505	100	100	100	100.0
Minima.	21.	5	17	7	6.2	5	2	0	5.0
				Total.	570.1				

.PPORO JAPAN.
)AL ELEVATION, 75 FEET.

Kind of Clouds.			Day of Month.	REMARKS.
f.	2 P.M.	9 P. M.		
	N.&Cu-s.	N.	1	
	C-cu.	S.	2	
s.	C-cu.	S.	3	
-s.	N & Cu-s.	S.	4	
	C-s.	S.	5	
	S.	S.	6	
	S.	S.	7	
s.	Cu-s.	S.	8	
	S.	N. & S.	9	
	N & Cu-s.	S.	10	
.	Cu-s.	S.	11	
S.	N. & Cu.	S.	12	
S.	S.	S.	13	
	N. & S.	N. & S.	14	
	Cu.	S.	15	
	Cu.	S.	16	
.	Cu.	S.	17	
	Cu-s.	—	18	
.-s.	Cu-s.	S.	19	
	Cu-s.	S.	20	
s.	C-cu-s.	S.	21	
	C-cu-s.	S.	22	
	Cu-s.	Cu-s.	23	
.-s.	Cu-s.	S.	24	
	S.	N. & S.	25	
	S.	S.	26	
	N.	N. & S.	27	Barometer, 11 P. M., 28.796.
.-s.	N.	N.	28	
	N.	N.&C-s.	29	
-s.	Cu-s.	C-s.	30	Lunar Halo, 9 P. M.
;S.	C-cu-s.	S.	31	{ Depth of snow, 8 to 12 ins. { No frost in the ground.
			Means.	
			Maxima.	
			Minima.	

ACE OF OBSERVATION, KIU HONJI
3′ 56″ N. LONGITUDE, 141° 22′ 49″

Day of Month.	ANEMOMETER.					CL			
		Progress of Wind.				Per cent. of Cloudiness.			
	7 A. M.	7 A. M. 10 hours.	2 P. M. 7 hours.	9 P. M. 7 hours.	Whole Day.	7 A. M.	2 P. M.	9 P. M.	Mean
1	33.7	94	81	44	219	40	40	5	28.
2	32.2	57	125	73	255	100	100	5	68.
3	35.0	46	87	45	178	0	25	15	13.
4	36.4	81	58	67	206	95	40	50	61.
5	33.8	104	117	86	307	100	70	50	73.
6	29.2	45	38	39	122	80	90	10	60.
7	36.9	41	95	58	194	3	15	0	6.
8	36.3	25	47	26	98	0	60	6	22.
9	36.0	31	10	14	55	100	100	100	100.
10	40.8	91	89	54	234	100	100	95	98.
11	36.0	53	64	87	204	100	70	95	88.
12	34.2	187	80	54	321	70	90	50	70.
13	31.0	32	30	48	110	20	15	0	11.
14	35.0	71	124	51	246	15	100	80	65.
15	38.4	122	44	69	235	100	80	95	91.
16	31.2	25	80	105	210	100	25	0	41.
17	31.0	38	80	132	250	20	5	25	16.
18	45.6	227	132	74	433	100	15	25	46.
19	36.2	60	78	74	212	1	5	3	3.
20	39.4	58	77	59	194	5	5	2	4.
21	42.5	137	128	99	364	75	50	40	55.
22	47.8	98	33	46	177	15	1	0	5.
23	46.7	39	86	46	171	5	30	40	25.
24	52.2	84	81	64	229	3	90	90	61.
25	45.0	63	80	55	198	100	10	1	37.
26	39.9	15	84	98	197	50	25	95	56.
27	50.8	154	174	107	435	100	85	100	95.
28	48.0	116	74	55	245	85	100	60	81.
29	52.4	80	87	49	216	40	2	3	15.
30	40.2	31	87	114	232	100	90	60	83.
Means.	39.65	76.83	81.67	66.40	224 90	57.40	51.00	40.00	49.5
Maxima.	52.6	227	174	132	435	100	100	100	100.
Minima.	29.0	15	10	14	55	0	1	0	3.0
				Total.	6747				

, SAPPORO JAPAN.
TIDAL ELEVATION, 75 FEET.

DS.

Kind of Clouds.			Day of Month.	REMARKS.
7 A. M.	2 P.M.	9 P. M.		
Cu-s.	Cu.	S.	1	
C-s.	S.	S.	2	
—	Haze & Cu.	S.	3	
N. & C-cu-s.	Cu.	S.	4	
N.	N.&Cu.	N. & S.	5	
C-s.	N. & S.	S.	6	
Cu-s.	Cu.	—	7	
—	C-s.	S.	8	
S.	N. & S.	N. & S.	9	
N.	N. & S.	S.	10	
N. & S.	N. & Cu.	N. & S.	11	
N.&Cu-s.	N. &Cu.	N.	12	
S.	Cu.	—	13	
C-s.	C-s.	S.	14	General Cultivation began about this time
S.	Cu-s.	S.	15	
Fog.	C-cu-s.	—	16	
S. & Haze	C-s.	C-s.	17	
N.	Cu.	C-s.	18	
Cu-s.	Cu.	S.	19	
S.	Cu.	C-s.	20	
C-s.	C-s.	C-s.	21	
C-s.	Cu s.	—	22	
C-s.	C-s.	C-s.	23	
C-s.	C-s.	C-s.	24	
S.	C-s.	C.	25	
C-s.	C-s.	S.	26	
N. & S.	N.&C-s.	S.	27	
S.	N.&C-s.	C-s.	28	Spring freshet in Toyohira river.
Cu-s.	C.	S.	29	
N. & S.	S.	S.	30	
			Means.	
			Maxima.	
			Minima.	

CE OF OBSERVATION, KIU HONJIN
3 56″ N. LONGITUDE, 141° 22′ 49″ E

Day of Month.	ANEMOMETER.					C			
		Progress of Wind.				Per cent. of Cloudness.			
	7 A. M.	7 A. M. 10 hours.	2 P. M. 7 hours.	9 P. M. 7 hours.	Whole Day.	7 A. M.	2 P. M.	9 P. M.	Means
1	48.5	165	82	76	323	100	10	30	46.7
2	47.2	78	95	94	267	35	80	5	40.0
3	43.5	79	71	58	208	85	90	35	70.0
4	42.3	22	128	60	210	3	20	25	16.0
5	42.2	26	86	22	134	100	100	100	100.0
6	41.0	11	112	70	193	60	30	3	31.0
7	37.0	12	103	20	135	2	100	90	64.0
8	45.9	22	56	67	145	100	100	50	83.3
9	48.4	78	55	67	200	85	5	15	35.0
10	44.0	9	80	45	134	2	3	4	3.0
11	42.0	4	54	34	92	80	95	80	85.0
12	43.4	55	23	24	102	100	100	100	100.0
13	36.6	52	43	62	157	100	100	100	100.0
14	41.0	83	85	74	242	90	90	15	65.0
15	43.4	134	170	182	486	100	100	100	100.0
16	50.5	139	131	80	350	10	95	95	66.7
17	44.0	134	74	41	249	30	20	25	25.0
18	44.5	249	152	102	503	100	100	25	75.0
19	47.4	75	124	69	268	5	50	0	18.3
20	57.6	70	89	62	221	50	100	90	80.0
21	56.4	29	32	38	99	15	70	65	50.0
22	49.1	8	41	68	117	100	10	100	70.0
23	45.0	22	44	39	105	100	20	100	73.3
24	52.8	24	67	58	149	20	80	98	66.0
25	46.8	96	110	108	314	5	40	90	45.0
26	43.6	136	100	64	300	100	100	20	73.3
27	47.8	108	64	68	240	95	95	50	80.0
28	46.8	132	87	133	352	60	95	20	58.3
29	54.6	27	44	37	108	35	98	100	77.7
30	55.0	71	42	45	158	50	45	95	63.3
31	48.0	11	22	21	54	100	98	85	94.3
Means.	46.2	69.71	79.55	64.13	213.39	61.84	69.00	58.39	63.07
Maxima.	57.4	249	170	182	503	100	100	100	100.0
Minima.	36.0	4	22	20	54	2	3	0	3.0
				Total.	6615				

SAPPORO, JAPAN.
TIDAL ELEVATION, 75 FEET.

JDS.				
KIND OF CLOUDS.			DAY OF MONTH.	REMARKS.
7 A. M.	2 P. M.	9 P. M.		
N. & S.	Cu.	Haze & S.	1	
Cu-s.	Cu-s.	S.	2	
C-s.	N. & C-cu-s.	S.	3	
C-s.	C.	S.	4	
S.	N.	N.	5	
N. & Cu-s.	Cu.	S.	6	
C-s.	Haze & S.	S.	7	
S.	S.	S.	8	
C-s.	Cu-s.	S.	9	
C-s.	Cu.	S.	10	
Haze & C-s.	C-s.	C-s.	11	
N. & S.	N.	N.	12	
N.	N. & S.	N. & S.	13	
S.	S.	S.	14	
S.	N. & S.	N.	15	
Cu-s.	Cu-s.	S.	16	
Cu-s.	C-cu-s.	C.	17	SOLAR HALO, 2. 15 P. M.
N. & C-s.	N. & S.	C-s.	18	
S.	Cu-s.	—	19	
Haze & S.	S.	S.	20	
C-s.	N. & Cu-s.	C-s.	21	LIGHTNING AND THUNDER, 10 A. M.
S.	Cu.	Fog & S.	22	RAINBOW 6. 30 P. M.
Fog & S.	Cu-s.	Fog & S.	23	
C-s.	Cu-s.	S.	24	SOLAR HALO, 1 P. M.
S.	C-s.	S.	25	
N. & S.	S.	C-s.	26	LUNAR HALO, 9 P. M.
C-s.	S.	C-s.	27	
C-s.	S.	S.	28	
C-s.	N. & S.	N.	29	
C-cu.	Cu.	N. & S.	30	
N.	N. & C.	Cu.	31	
			MEANS.	
			MAXIMA.	
			MINIMA.	

CE OF OBSERVATION, KIU HONJIN
' 56" N. LONGITUDE, 141° 22' 49" E

Day of Month.	ANEMOMETER.					CL			
		Progress of Wind.				Per cent. of Cloudness.			
	7 A.M.	7 A. M. 10 hours.	2 P. M. 7 hours.	9 P. M. 7 hours.	Whole Day.	7 A. M.	2 P. M.	9 P. M.	Means
1	470	45	68	71	184	100	65	99	88.0
2	510	9	13	32	54	40	65	3	36.0
3	589	55	112	84	251	80	50	2	44.0
4	630	99	90	80	269	1	4	1	2.0
5	686	82	102	86	270	3	50	40	31.0
6	580	170	135	75	380	100	99	20	73.0
7	560	86	86	85	257	75	80	12	55.7
8	624	91	80	84	255	6	45	30	27.0
9	520	105	23	55	183	100	100	100	100.0
10	500	123	27	23	173	90	65	2	52.3
11	534	46	136	119	301	1	45	98	48.0
12	523	63	72	37	172	100	95	2	65.7
13	564	22	22	31	75	35	25	90	50.0
14	650	75	82	37	194	5	75	75	51.7
15	618	18	33	58	109	3	15	96	38.0
16	552	30	30	21	81	95	95	98	96.0
17	590	38	36	31	105	100	100	100	100.0
18	556	7	31	19	57	100	98	3	67.0
19	556	34	34	36	104	35	60	2	32.3
20	574	49	82	81	212	100	80	80	86.7
21	610	86	75	39	200	100	95	100	98.3
22	620	44	20	36	100	95	30	5	43.3
23	604	25	76	77	178	25	45	0	23.3
24	684	27	60	28	115	5	15	50	23.3
25	674	68	29	32	129	60	97	100	85.7
26	663	55	102	56	213	95	100	100	98.3
27	540	87	112	53	252	60	90	50	66.7
28	580	130	107	10	247	100	98	95	97.7
29	590	6	35	40	81	80	30	85	65.0
30	620	22	28	23	73	30	80	98	69.3
Means.	584	59.90	64.60	51.30	175.80	60.63	66.37	54.53	60.51
Maxima.	684	170	136	119	380	100	100	100	100.0
Minima.	470	6	13	10	54	1	4	0	2.00
				Total.	5274				

SAPPORO, JAPAN.
TIDAL ELEVATION, 75 FEET.

DS.				
KIND OF CLOUDS.			DAY OF MONTH.	REMARKS.
7 A. M.	2 P. M.	9 P. M.		
N.	Cu.	N. & S.	1	
C-cu.	C-cu-s.	Cu-s.	2	
C-s.	C	C.	3	
C.	C-cu-s.	C.	4	
C-cu.	C-s.	C-cu.	5	
N.	N.	Cu.	6	
C-cu.	C-cu-s.	Cu.	7	
C-s.	Cu-s.	S.	8	Solar halo, 6.30 P. M.
N.	N.	N.	9	
C-cu.	C-cu-s.	Cu-s.	10	
C-s.	C-s.	S.	11	
N.	Cu-s.	S.	12	
C-s.	Cu.	N. & S.	13	
C-cu.	C-cu.	S.	14	
S.	Cu.	S.	15	
C-s.	C-cu-s.	S.	16	
S.	N. & S.	N. & S.	17	
S.	Cu-s.	S.	18	
C-cu-s.	Cu.	S.	19	
C-s.	C-s.	C-cu-s.	20	
N.	N. & C-s.	S.	21	
S.	Cu.	C-s.	22	
Cu-s.	Cu.	—	23	
C-s.	C-cu-s.	C-s.	24	
C-cu-s.	C-cu-s.	S.	25	
N. & S.	N. & S.	N.	26	
C-s.	Cu-s.	C-s.	27	
S.	S.	S.	28	
C-s.	C.	C-cu-s.	29	Solar halo, 7 A. M,
C.	C-cu-s.	S.	30	
			MEANS.	
			MAXIMA.	
			MINIMA.	

CE OF OBSERVATION, KIU HONJI
56″ N. LONGITUDE, 141° 22′ 49″ E

Day of Month.	7 A.M.	Progress of Wind.				Per cent. of Cloudiness.			
		7 A. M. 10 hours.	2 P. M. 7 hours.	9 P. M. 7 hours.	Whole Day.	7 A. M.	2 P. M.	9 P. M.	Means.
1	60.6	13	68	26	107	40	70	10	40.6
2	66.4	19	41	27	87	15	30	10	18.
3	62.0	16	74	41	131	75	80	15	56.
4	67.8	16	58	57	131	20	100	100	73.
5	61.8	23	78	81	182	40	45	2	29.
6	59.0	15	18	33	66	10	5	5	6.
7	58.2	19	54	34	107	15	5	5	8.
8	59.5	39	84	94	217	80	90	85	85.6
9	62.2	88	58	58	204	100	80	80	86.
10	66.0	15	42	90	147	75	85	100	86.
11	67.5	87	50	30	167	50	80	98	76.
12	64.2	25	50	8	83	100	100	95	98.
13	66.5	53	82	25	160	100	65	75	80.
14	63.7	10	50	33	93	95	95	100	96.
15	67.0	22	105	45	172	75	95	80	83.
16	66.1	13	37	35	85	100	80	95	91.
17	65.7	25	15	28	68	95	40	50	61.
18	70.6	72	90	95	257	60	10	25	31.
19	67.4	100	75	55	230	98	100	90	96.
20	68.0	20	28	27	75	98	98	100	98.
21	70.2	15	23	32	70	10	70	100	60.
22	67.8	19	31	35	85	100	98	100	99.
23	68.0	35	25	115	175	50	25	5	26.
24	70.0	130	100	77	307	98	100	65	87.
25	73.4	116	70	32	218	50	70	80	66.
26	79.2	85	80	100	265	10	5	5	6.
27	74.0	115	101	79	295	98	100	100	99.
28	72.7	93	60	17	170	100	95	100	98.
29	71.9	23	55	15	93	100	90	0	63.
30	74.4	20	22	23	65	90	75	5	56.
31	75.4	48	27	20	95	100	100	100	100.0
Means.	67.?	44.81	56.48	47.32	148.61	69.26	70.35	60.65	66.75
Maxima.	79	130	105	115	307	100	100	100	100.0
Minima.	58	10	15	8	6.5	10	5	0	6.7
				Total.	4607				

SAPPORO JAPAN.
TIDAL ELEVATION, 75 FEET.

DS.

Kind of Clouds.			Day of Month.	REMARKS.
7 A. M.	2 P.M.	9 P. M.		
C-cu-s.	Cu.	S.	1	
C-s.	C.	C-s.	2	
C-s.	C-cu-s.	S.	3	[Sapporo.
Cu-s.	N. & S.	N.	4	Snow disappeared on Mts. west from
Cu.	Cu.	S.	5	
C-s.	Cu-s.	S.	6	
C-s.	Cu.	S.	7	
C-s.	C-cu-s.	S.	8	
N.	N.&C-cu.	N. & S.	9	
N.&Cu-s.	N.&C-cu.	S.	10	
C-s.	Cu-s.	S.	11	
S.	N. & S.	S.	12	
S.	C-cu-s.	S.	13	
S.	Cu-s.	S.	14	
C-s.	Cu-s.	S.	15	
S.	N & C-cu-s.	C-s.	16	
S.	C-cu-s.	C-s.	17	
C-s.	Cu-s.	S.	18	
S.	N. & S.	S.	19	
S.	S.	S.	20	
S.	Cu-s.	S.	21	
N.	S.	S.	22	Lightning and thunder. Night A.M.
C-s.	C-s.	S.	23	
S.	S.	S.	24	
C-s.	C-cu-s.	S.	25	
C-s.	Cu-s.	S.	26	
N. & S.	N. & S.	S.	27	
S.	S.	S.	28	
S.	S.	—	29	
S.	C-cu-s.	S.	30	
N.	N.	N.	31	
			Means.	
			Maxima.	
			Minima.	

...CE OF OBSERVATION, KIU HONJII
...3′ 56″ N. LONGITUDE, 141° 22′ 49″

Day of Month.	ANEMOMETER.					C...			
		Progress of Wind.				Per cent. of Cloudness.			
	7 A. M.	7 A. M. 10 hours.	2 P. M. 7 hours.	9 P. M. 7 hours.	Whole Day.	7 A. M.	2 P. M.	9 P. M.	Mean
1	7...2	13	25	37	75	90	70	100	86.7
2	7...4	20	45	25	90	90	100	85	91.7
3	68.2	18	42	35	95	30	70	7	35.7
4	68.4	27	55	35	117	75	80	0	51.7
5	71.6	31	67	52	150	5	0	35	13.3
6	70.2	49	27	30	106	50	25	30	35.0
7	70.4	16	29	30	75	20	7	0	9.0
8	71.6	47	88	63	198	3	5	8	5.3
9	72.4	48	47	40	135	10	20	10	13.3
10	74.0	70	98	96	264	10	5	10	8.3
11	74.6	82	115	98	295	75	50	70	65.0
12	74.0	140	105	103	348	99	75	65	79.7
13	73.0	127	130	97	354	95	20	2	39.0
14	74.0	123	95	63	281	10	3	2	5.0
15	70.6	84	102	52	238	60	5	90	51.7
16	68.4	10	7	18	35	100	100	10	70.0
17	67.4	7	75	76	158	95	65	30	63.3
18	67.3	57	64	93	214	85	50	40	58.3
19	65.1	23	34	46	103	98	100	100	99.3
20	66.4	19	31	79	129	98	60	15	57.7
21	63.6	18	60	66	144	5	40	80	41.7
22	67.0	98	107	71	276	80	90	100	90.0
23	67.6	97	68	47	212	80	60	10	50.0
24	64.6	8	39	26	73	75	75	50	66.7
25	69.0	32	75	34	141	15	30	95	46.7
26	69.0	13	54	37	104	100	60	100	86.7
27	68.6	40	78	109	227	100	100	99	99.7
28	61.9	53	36	52	141	99	98	40	79.0
29	65.0	74	77	51	202	50	60	95	68.3
30	60.2	27	69	44	140	5	70	95	56.7
31	57.0	22	39	64	125	100	20	100	73.3
Means.	68.3	48.16	63.97	57.06	169.19	61.52	52.03	50.74	54.76
Maxima.	75.0	140	130	109	354	100	100	100	99.7
Minima.	57.0	7	7	18	35	3	0	0	5.0
				Total.	5245				

LOUDS.

s.	Kind of Clouds. 7 A. M.	2 P. M.	9 P. M.	Day of Month.	REMARKS.
	S.	Cu-s.	N.	1	Lightning and thunder, 2 to 4, P.M.
	C-cu.	N.	N. & S.	2	„ „ „ 11 A.M. to 3. P.M.
	Cu-s.	C-cu.	C-s.	3	
	C-cu-s.	N.&Cu-s.	—	4	
	C-s.	—	S.	5	
	S.	C-cu.	S.	6	
	S.	C.	—	7	
	S.	Cu.	S.	8	
	C-s.	C-cu.	S.	9	
	C-cu-s.	Cu.	Cu-s.	10	
	S.	Cu.	S.	11	
	N. & S.	C-cu-s.	S.	12	Rainbow, 6 P.M.
	N.&Cu-s.	Cu.	S.	13	
	Cu-s.	Cu-s.	S.	14	
	C-cu-s.	Cu-s.	S.	15	
	S.	N. & S.	S.	16	
	N & C-cu-s.	C-cu-s.	C-cu-s.	17	
	N.&Cu-s.	Cu-s.	C-s.	18	
	C-s.	N. & C-cu-s.	N.	19	
	S.	Cu.	N.&C-s.	20	Lunar rainbow, 9.30. P.M.
	C-s.	Cu.	C-cu-s.	21	
	C-cu-s.	C-cu-s.	S.	22	
	C-cu-s.	C-cu-s.	C-s.	23	
	C-cu-s.	Cu.	C-s.	24	
	S.	C-cu.	S.	25	
	S.	C-cu-s.	N. & S.	26	
	N.	N.	S.	27	
	Fog & S.	N & C-cu-s.	N.&C-s.	28	Rainbow, 1.45 P.M.
	Cu-s.	Cu.	S.	29	„ 6.30 P.M., with *three* super-numerary bows.
	C-s.	Cu-s.	S.	30	
	S.	Cu.	S.	31	
				Means.	
				Maxima.	
				Minima.	

...CE OF OBSERVATION, KIU HONJIN...
...R... 56″ N. LONGITUDE, 141° 22′ 49″ E...

Day of Month.	...NEMOMETER. 7 A. M.	Progress of Wind. 7 A. M. 10 hours.	2 P. M. 7 hours.	9 P. M. 7 hours.	Whole Day.	Per cent. of Cloudiness. 7 A. M.	2 P. M.	9 P. M.	Means	CLO...
1	62.19	78	79	74	231	100	25	10	45.	
2	64.30	11	66	57	134	85	40	30	42.	
3	56.20	9	41	33	83	3	20	5	9.	
4	58.70	23	22	28	73	10	55	5	23.	
5	69.26	3	26	37	66	98	97	100	98.	
6	56.22	22	45	61	128	95	10	2	35.	
7	55.64	18	17	42	77	40	10	0	16.	
8	50.60	27	36	62	125	2	40	2	14.	
9	62.00	73	105	119	297	95	98	100	97.	
10	63.27	156	100	89	345	100	95	65	86.	
11	61.53	60	52	50	162	2	50	70	40.	
12	61.00	34	27	33	94	65	10	5	26.	
13	59.04	24	36	32	92	5	20	0	8.	
14	54.00	26	32	48	106	20	80	95	65.	
15	58.06	42	16	10	68	100	100	99	99.	
16	60.08	19	50	60	129	90	50	50	63.	
17	58.58	40	11	19	70	100	85	80	88.	
18	60.06	32	38	44	114	10	5	3	6	
19	64.02	67	45	32	144	5	50	2	19.	
20	58.08	17	40	58	115	3	70	98	57.	
21	57.50	29	73	43	145	50	5	5	20.	
22	44.80	22	37	73	132	5	5	5	5.	
23	65.30	128	137	109	374	65	90	100	85.	
24	65.86	81	31	23	135	15	40	25	26.	
25	53.82	25	51	31	107	100	85	10	65.	
26	45.08	13	23	29	65	3	5	4	4	
27	45.63	17	27	32	76	5	95	12	37.	
28	49.10	37	31	33	101	30	85	2	39.	
29	46.09	19	43	33	95	5	60	5	23.	
30	53.59	47	56	61	164	3	15	5	7.	
Means.	57.30	39.97	46.43	48.50	134.90	43.63	49.83	32.23	41.9	
Maxima.	69.20	156	137	119	374	100	100	100	99.7	
Minima.	44.80	3	11	10	65	2	5	0	4.0	
				Total.	4047					

SAPPORO JAPAN.
TIDAL ELEVATION, 75 FEET.

DS.

Kind of Clouds.			Day of Month.	REMARKS.
7 A. M.	2 P.M.	9 P. M.		
N.	Cu-s.	S.	1	
N. & C-cu-s.	Cu.	S.	2	Rainbow 7.30 A.M.
C-s.	C.	S.	3	
S.	Cu-s.	S.	4	
S.	N.&Cu-s.	S.	5	Lightning and thunder, P. M.
S.	Cu.	S.	6	
Cu-s.	Cu.	—	7	
S.	Cu.	S.	8	
S.	N. & S.	N. & S.	9	
N.	N.&C-cu.	N. & S.	10	
S.	Haze & C-cu-s.	Haze & S.	11	
C-cu-s.	Cu.	S.	12	
Cu-s.	Cu.	—	13	
C-s.	C-s.	S.	14	
N.	N.	S.	15	
S.	C-cu-s.	C-cu-s.	16	
S.	Cu-s.	Cu-s.	17	Rainbows P. M.
Cu-s.	Cu.	S.	18	
C-s.	Cu.	S.	19	
S.	N.&Cu-s.	N. & S.	20	
Cu-s.	Cu-s.	S.	21	
C-s.	C-s.	C-s.	22	
C-s.	C-cu-s.	N. & S.	23	
Cu-s.	C-cu-s.	C-s.	24	
C-s.	S.	C-s.	25	
S.	Cu-s.	Cu-s.	26	
S.	N.&Cu-s.	Cu-s.	27	Lightning and thunder, 1.45 P. M.
Cu-s.	Cu.	S.	28	
S.	Cu.	S.	29	
S.	Cu.	S.	30	
			Means.	
			Maxima.	
			Minima.	

ACE OF OBSERVATION, KIU HONJI
3′ 56″ N. LONGITUDE, 141° 22′ 49″

Day of Month.	7 A.	P. M.	ANEMOMETER. Progress of Wind. 7 A. M. 10 hours.	2 P. M. 7 hours.	9 P. M. 7 hours.	Whole Day.	Per cent. of Cloudiness. 7 A. M.	2 P. M.	9 P. M.	Mea
1	50.	6.0	39	61	51	151	10	35	10	18
2	51.	2.7	36	75	73	184	10	35	70	38
3	58.	5.8	85	58	24	167	95	100	100	98
4	53.	0.0	33	19	27	79	90	98	50	75
5	53.	1.2	5	30	19	54	70	70	5	48
6	50.	2.9	13	18	16	47	70	80	50	66
7	56.	6.0	13	44	60	117	98	50	90	79
8	54.	1.9	63	48	27	138	10	50	5	21
9	43.	1.4	19	19	15	53	3	45	0	16
10	42.	6.5	12	38	41	91	50	85	80	71
11	55.	1.9	35	28	30	93	100	100	100	100
12	57.	4.4	35	53	47	135	85	80	65	76
13	51.	4.8	54	55	49	158	90	80	75	81
14	50.	3.4	31	65	75	171	20	80	90	63
15	49.	2.6	34	34	12	80	95	95	98	96
16	43.	2.9	10	26	29	65	5	80	75	53
17	49.	0.0	47	71	37	155	75	60	5	46
18	39.	1.4	33	57	28	118	7	85	75	55
19	38.	6.0	11	33	48	92	0	3	96	33
20	47.	0.6	48	59	63	170	100	75	70	81
21	50.	3.6	123	78	47	248	90	100	100	96
22	48.	3.6	37	25	27	89	100	15	75	63
23	42.	3.6	14	30	53	97	10	75	25	36
24	42.	0.0	38	34	23	95	80	75	60	71
25	33.	0.0	7	11	9	27	2	10	85	32
26	39.	4.8	25	14	41	80	45	100	35	60
27	39.	4.2	36	66	89	191	10	95	100	68
28	45.	6.7	88	50	47	185	90	50	3	47
29	37.	7.2	48	55	39	142	7	70	7	28
30	51.	0.2	86	40	50	176	15	80	97	64
31	45.	2.4	95	60	35	190	95	25	15	45
Means.	47.4	15	40.42	43.68	39.71	123 81	52.48	67.13	58.42	59.
Maxima.	58.	7	123	78	89	248	100	100	100	100
Minima.	33.	0	5	11	9	27	0	3	0	16
					Total.	3838				

N, SAPPORO JAPAN.
E. TIDAL ELEVATION, 75 FEET.

OUDS.

ws.	Kind of Clouds. 7 A. M.	2 P.M.	9 P. M.	Day of Month.	REMARKS.
.3	C-s.	Cu-s.	S.	1	
.3	C-cu-s.	Cu-s.	S.	2	
.3	N.&C-s.	N. & S.	N.	3	Rainbows, 4.30 and 5, P. M. Severe lightning and thunder during evening.
.3	N. & C-cu-s.	N. & C-cu-s.	S.	4	
.3	S.	Cu-s.	S.	5	Rainbows 2 and 3. P. M.
.7	C-s.	Cu-s.	S.	6	Rainbows P. M. Thunder P. M.
.3	S.	Cu-s.	S.	7	
.7	S.	Cu.	S.	8	Rainbows A. M.
.0	Cu-s.	Cu.	—	9	
.7	C-s.	C-cu-s.	S.	10	
.0	S.	N.	N.	11	
.7	N.&Cu-s.	N.&Cu.	S.	12	Rainbow 7 A. M.
.7	S.	Cu-s.	S.	13	
.3	Cu-s.	N.&Cu-s.	N.&Cu-s.	14	Rainbows 1.20 and 2.20 P. M.
.0	N. & S.	N.&Cu-s.	S.	15	Rainbow 2 P. M.
.3	S.	Cu-s.	S.	16	
.7	C-s.	Cu.	S.	17	
.7	Cu-s.	C-cu-s.	C-cu-s.	18	First frost of the season [this A. M.
.0	—	Cu-s.	C-cu-s.	19	First snow on East Mts. appeared
.7	S.	S.	Cu-s.	20	
.7	S.	S.	N. & S.	21	
.3	N.	Cu-s.	Cu-s.	22	
.7	S.	C-cu-s.	C-cu-s.	23	[this A. M.
.7	Cu-s.	N.&Cu-s.	C-cu-s.	24	First snow on Mt. Tiene appeared.
.3	Cu-s.	C-cu-s.	Cu-s.	25	Earthquake, 6.45 A. M.
.0	C-cu-s.	S.	S.	26	Lightning 6.40 P. M.
.3	Cu-s.	N.&Cu-s.	N.	27	Compound rainbow, P. M. Lightning and thunder 11 P. M.
.7	Cu-s.	Cu-s.	S.	28	
.0	S.	Cu-s.	S.	29	
.0	Cu-s.	C-cu-s.	N.&Cu-s.	30	Distant lightning 8 P. M.
.0	Cu-s.	Cu.	S.	31	
4				Means.	
0				Maxima.	
				Minima.	

CE OF OBSERVATION, KIU HONJIN
56″ N. LONGITUDE, 141° 22′ 49″ E

Day of Month.	7 A.	NEMOMETER.					C			
		M.	Progress of Wind.				Per cent. of Cloudiness.			
			7 A. M. 10 hours.	2 P. M. 7 hours.	9 P. M. 7 hours.	Whole Day.	7 A. M.	2 P. M.	9 P. M.	Mean
1	36.	5	30	26	25	81	15	15	95	41.7
2	42.	2	64	68	61	193	85	45	100	76.7
3	41.	8	83	98	39	220	98	95	25	72.7
4	34.	0	58	37	22	117	40	85	100	75.0
5	35.	0	26	49	49	124	99	80	50	76.3
6	30.	4	39	49	21	109	30	85	15	43.3
7	31.	8	26	41	41	108	45	50	100	65.0
8	30.	4	68	33	63	164	50	100	40	63.3
9	30.	0	69	29	26	124	100	100	100	100.0
10	25.	6	32	53	63	148	20	75	10	35.0
11	35.	4	28	16	22	66	80	75	90	81.7
12	38.	2	41	41	44	126	100	90	60	83.3
13	33.	0	31	72	66	169	100	100	100	100.0
14	41.	0	70	65	136	271	85	70	100	85.0
15	32.	8	107	73	47	227	90	100	70	86.7
16	27.	2	36	46	48	130	50	100	100	83.3
17	40.	2	107	126	123	356	100	15	95	70.0
18	36.	1	64	30	36	130	95	75	100	90.0
19	25.	2	44	50	61	155	25	60	90	58.3
20	31.	1	56	22	16	94	95	100	100	98.3
21	34.	4	28	14	13	55	90	98	7	65.0
22	30.	0	28	28	33	89	80	95	30	68.3
23	31.	0	8	20	10	38	10	100	100	70.0
24	36.	0	10	25	31	66	97	97	100	98.0
25	39.	6	120	82	95	297	98	60	45	67.7
26	30.	0	24	9	8	41	99	100	100	99.7
27	30.	0	17	18	36	71	40	40	50	43.3
28	29.	2	46	33	71	150	95	60	100	85.0
29	29.	2	41	62	38	141	100	100	40	80.0
30	30.	0	57	45	18	120	95	75	80	83.3
Means.	33.3	21	48.60	45.33	45.40	139.33	73.53	78.00	73.07	74.8
Maxima.	42.	2	120	126	136	356	100	100	100	100.
Minima.	25.	0	8	9	8	38	10	15	7	35.0
					Total.	4180				

, SAPPORO, JAPAN.
. TIDAL ELEVATION, 75 FEET.

LOUDS.				
KIND OF CLOUDS.			DAY OF MONTH.	REMARKS.
7 A. M.	2 P. M.	9 P. M.		
C-s.	C.	C-s.	1	
N. & S.	C-cu-s.	N.	2	
N.	N.&Cu-s.	S.	3	
S.	Cu-s.	N.	4	
N. & S.	N.&Cu-s.	N. & S.	5	
N. & S.	N.&Cu.	S.	6	
C-s.	N.&Cu-s.	N.	7	
Cu-s.	N. & S.	N.&S.	8	
N. & S.	N.	S.	9	
S.	C-cu-s.	S.	10	Snow all melted.
Cu-s.	N.&Cu-s.	S.	11	
S.	Cu-s.	C-s.	12	
S.	S.	N.	13	
N.&Cu-s.	N.&Cu-s.	N.	14	Rainbows 7.20 A. M.
N. & S.	N.	S.	15	
C-s.	C-s.	N.	16	Snow all melted.
N.	N & Cu.	N. & S.	17	Rainbows, A. M. and P. M. At 1 P. M., Barometer, 29.300
C-cu-s.	Cu-s.	Haze & C-s.	18	Direction of Wind, W.S.W.
N.&Cu-s.	N.&Cu-s.	N.&Cu-s.	19	Velocity „ „ 36.0.
S.	N.&Cu-s.	N. & S.	20	Earthquake, 6.10 A.M.
S.	S.	S.	21	Snow all melted.
C-s.	S.	C-s.	22	
C-s.	S.	N.	23	
N.&S.	S.	S.	24	
N. & S.	N.&Cu-s.	N. & S.	25	Rainbows, A. M. and P. M.
S.	S.	S.	26	
S.	Cu.	S.	27	
S.	C-cu-s.	S.	28	
N. & S.	N.	S.	29	
S.	N.&Cu-s.	S.	30	
			MEANS.	
			MAXIMA.	
			MINIMA.	

CE OF OBSERVATION, KIU HONJIN
56″ N. LONGITUDE, 141° 22′ 49″ E

DAY OF MONTH.	7 A.	M.	NEMOMETER. PROGRESS OF WIND. 7 A. M. 10 hours.	2 P. M. 7 hours.	9 P. M. 7 hours.	WHOLE DAY.	PER CENT. OF CLOUDNESS. 7 A. M.	2 P. M.	9 P. M.	MEANS	C
1	35.	6	33	54	43	130	100	100	100	100.0	
2	45.	4	70	65	20	155	75	80	85	80.0	
3	33.	4	30	28	21	79	30	95	70	65.0	
4	29.	2	14	9	18	41	98	95	100	97.7	
5	28.	2	61	27	24	112	100	5	90	65.0	
6	24.	4	48	59	60	167	95	100	100	98.3	
7	42.	0	136	63	56	255	95	75	20	63.3	
8	22.	1	11	38	43	92	70	60	3	44.3	
9	27.	8	36	28	24	88	3	20	70	31.0	
10	33.	7	28	44	58	130	75	20	30	41.7	
11	28.	3	73	32	21	126	70	60	5	45.0	
12	31.	0	56	27	43	126	85	100	15	66.7	
13	28.	3	31	12	23	66	95	100	100	98.3	
14	25.	8	41	49	30	120	7	2	15	8.0	
15	18.	8	30	14	31	75	40	85	60	61.7	
16	35.	7	50	68	90	208	70	65	100	78.3	
17	25.	2	140	74	39	253	40	98	15	51.0	
18	21.	1	21	15	31	67	15	90	5	36.7	
19	19.	3	29	33	39	101	90	85	12	62.3	
20	18.	3	24	29	25	78	50	10	20	26.7	
21	16.	0	35	63	51	149	10	90	100	66.7	
22	18.	0	76	20	17	113	15	80	65	53.3	
23	20.	4	37	19	31	87	50	70	15	45.0	
24	17.	0	37	11	6	54	80	80	100	86.7	
25	16.	2	5	28	47	80	95	100	20	71.7	
26	6.	6	28	35	45	108	5	25	80	36.7	
27	22.	8	59	34	15	108	90	50	40	60.0	
28	30.	0	22	17	11	50	100	75	25	66.7	
29	18.	0	20	47	17	84	30	100	100	76.7	
30	18.	6	9	34	10	53	10	50	100	53.3	
31	14.	7	10	4	11	25	90	100	60	83.3	
MEANS.	24.	5	41.94	34.84	32.26	109.03	60.58	69.84	55.48	61.97	
MAXIMA.	45.	1	140	74	90	255	100	100	100	100.0	
MINIMA.	6.	0	5	4	6	25	3	2	3	8.0	
					Total.	3380					

T, SAPPORO, JAPAN.
E. TIDAL ELEVATION, 75 FEET.

LOUDS.				
KIND OF CLOUDS.			DAY OF MONTH.	REMARKS.
7 A. M.	2 P. M.	9 P. M.		
S.	N. & S.	N.	1	
N & C-cu-s.	N.&Cu-s.	N. & S.	2	Rainbow at noon.
N. & S.	N.&Cu-s.	S.	3	No snow in open fields.
S.	S.	N.	4	Earthquake, 3.40 P.M.
N.	Cu-s.	S.	5	
S.	S.	N. & S.	6	
N. & S.	N.&Cu.	S.	7	
S.	Cu-s.	S.	8	
S.	C-cu-s.	S.	9	
N.&C-s.	N. & C-cu-s.	N. & S.	10	
N.&Cu-s.	Cu-s.	S.	11	
S.	N. & S.	Cu-s.	12	
S.	S.	Haze & S.	13	
C-s.	S.	C-s.	14	
C-s.	Cu-s.	S.	15	
C-s.	C-cu-s.	N. & S.	16	
C-s.	N. & S.	Cu-s.	17	
S.	N & Cu.	C.	18	
S.	S.	C-s.	19	
C-cu-s.	Cu-s.	S.	20	
N.&S.	N. & S.	N.	21	
S.	N.&Cu.	N.&Cu-s.	22	
S.	N.&Cus.	N.&Cu-s.	23	
N. & S.	N.	N.	24	
N. & S.	N.	S.	25	Earthquake, 9.30 A.M.
S.	N.&Cu.	N.	26	
N. & S.	N. & S.	S.	27	
N. & S.	Cu-s.	S.	28	
S.	N.	N.	29	
S.	N & C-cu-s.	N.	30	Depth of snow in fields, 9 ins.
S.	N. & S.	N. & S.	31	Depth of frozen ground, 5 ins.
			MEANS.	
			MAXIMA.	
			MINIMA.	

CONTRIBUTIONS

TO

THE NATURAL HISTORY OF HOKKAIDO.

BY

PROF. D. P. PENHALLOW. B. S.

CONTRIBUTIONS TO THE NATURAL HISTORY OF YESSO.

From the variety of soil and the conformation of the surface, allowing sudden and great variations in altitude and exposure, the island of Yesso offers peculiar advantages for the study of plants in their distribution as affected by such influences. The long extent of coast line incident to the insular condition of Yesso presents opportunity for the study of marine flora and fauna through a considerable range of latitude, while the character of the island itself affords opportunity for observing varied geological formations and changes within a limited area.

The following will present a summary of observations made during the past summer.

BOTANY.

The island of Yesso, as a whole, is covered with a heavy growth of forest almost entirely primeval, and containing many trees valuable for timber.

In the valley of the Ishicari, the trees, noticeably large towards the mouth of the river, decrease in size as the upper valley is approached, where they are sheltered on the east and west by mountains, forming a growth of apparently recent date.

The compact alluvium of the bottom lands does not allow of very perfect drainage, and, in consequence, until the alluvial deposit is reduced to a few feet in thickness, covering drift substrata, there are to be

found numerous tracts that are semi-swampy in their nature, and drained only by the many small streams emptying into the Ishicari at various intervals.

It is along the banks of these streams where the drainage is best, that the trees of the valley are principally found, apparently limited in location by the excessive moisture of the land. Thus from an elevated post of observation such as Mt. Kumanuisuri, which stands at the junction of the upper and lower valleys, the low land appears as a vast grassy plain intersected by numerous broad belts of trees following the course of the streams, and gradually coalescing into dense, uniform growth as the lower slopes of the hills are reached.

The ash is by far the predominating tree of the whole valley bottom, with which are mingled one or two species of elms ; and where the ground is more dry will be found maple, mulberry, walnut and last oak. Alders and willows are naturally common along all the streams and particularly on the curves of the Ishicari river, their location being so definite as to allow their limits of growth and position to be previously marked on the map with great exactness.

One noticeable feature in the distribution of willows is their growth along the Toyohira river. Ten and twelve feet above water, the banks are fringed on each side with a belt of willows extending from Sapporo to within a short distance of the Ishicari river. The growth is so peculiarly of willows as to exclude trees of other kinds except an occasional alder. Examined from above, the trees appear to originate in the surface soil. Examined from below, it will be seen that their true point of origin is often six, eight or ten feet below the surface of the bank.

Thus where the bank is washed away the half-exposed trunks may be seen, from which secondary roots branch in all directions, from the true crown of the original roots to the point of emergence from the soil.

This certainly seems to be indicative of the recent formation of the river banks, at least in the immediate vicinity of such trees. It was noticeable also that during the autumn of 1876 a deposit of several inches was made on either side of the river. The same process seems to be going on at the present day on all the sharper curves of the Ishicari river as well as those of its tributaries.

Wherever the river curves considerably there in a shoal on the concave side, upon which willows find suitable ground for growth and constantly encroach upon the water line, forming barriers to the progress of drift material, which, once lodged, forms the basis for more general and earthy deposits.

As the land rises towards the Sapporo plain, the character of the forest experiences a marked change. There the ash is no longer the predominating tree, but is replaced by oaks, of which there are four species, katsura (*Circidiphyllum Japonicum*), various species of *Prunus* and *Pyrus*, chesnut and beech, though the latter is not abundant until more elevated localities are reached.

This change in the forests is seen to extend through the whole valley wherever the long slopes of the mountains meet the bottom lands, as far as the Sorachi river, where the rapid uniform rise of the land from alluvial soil to formations of an earlier date renders the change more striking.

At a slightly higher elevation another change is

evident. A slight elevation above the plain of Sapporo, such as would be reached by crossing one of the lava ridges, or ascending the foot-slopes of the adjacent mountains, brings us into a very different floral region in which are to be found representatives of such genera as *Abies (Todomatsû)*, *Magnolia*, *Tilia*, *Fagus*, *Carpinus*, *Castanea* and *Circidiphyllum*. Greater elevation brings us into the region where birch and *Abies Yesoensis (Yesso matsû)* predominate, and this section extends to the limit of trees. Thus there appear to be five distinct floral regions in point of elevation, in the distribution of the native trees, in the first two of which, however, character of soil and drainage seem to be the controlling influences.

Also since the third region commences at an elevation but slightly above the first, much of the character of the vegetation is undoubtedly referable to effect of soil and drainage.

Strict limits cannot be assigned, since conformation of the surface and other physical conditions may cause the species of one region to merge more or less into those adjacent. Thus on Mt. Kumanuisuri at an elevation of 2000 feet were found one or two plants of the order *Asclepiadaceae*, the natural habitat of which is the dry land of the plains. It was somewhat of a surprise, however, to find on the same southern slope, at the same elevation, and amid flowering plants, quite a mass of snow ice on the 3rd of August.

Bamboo grass *(Arundinaria)* is common to all elevations within the limit of trees. Moist land is evidently not well suited to its growth, attaining in such places a height of but one or two feet; but with elevation, it becomes taller and stouter, and as far as observations have extended is invariably found in very

dense and apparently its most luxuriant growth just below the mountain summits. On the lower summit of Mt. Kumanuisuri, at an elevation of 2900 feet, was sound *Viburnum lantanoides.*

On the summit of a mountain near the source of the Ashibets river, elevation 4000 feet, were found a birch tree closely resembling *Betula excelsa,* measuring 8.5in. in circumference, a species of *Acer, Viburnum lantanoides,* and an oak *(Quercus serratus ?).*

If we carefully examine the distribution of those trees of special value for timber of various kinds, it will be found that ash, elm and maple are to be found generally distributed over the plains. With more elevation, as in the vicinity of the Sorachi river, katsura *(Circidiphyllum)* appears in great abundance, and is to be found on all the lower slopes of the mountains below an elevation of from eight hundred to one thousand feet, sometimes being found as high as fifteen hundred feet. The large size of this tree, and the close firm grain of the wood, render it valuable for timber. The peculiar character of the foliage, which is small and dense, as well as the general form of the tree render it worthy of special consideration for ornamental purposes.

Accompanying it are to be found two species of *Tilia* (Shina), the bark of which is utilized for ropes. *Magnolia,* of which there are also two species, is here found in its true habitat, while various species of maple *(Acer)* are common everywhere.

Two species of *Abies,* known by the Japanese as Todo and Yesso Matsu, supply the same wants which the white pine meets in New England. The " Todo Matsu " is found wherever the land has an elevation of about two or three hundred feet above the plain,

and it is therefore met with largely just south from Sapporo on the lava ridges, more sparingly on the mountains to the westward, but again appears in abundance in the elevated land of the Ashibets river valley, gradually disappearing at a height of 2800 feet, where it is replaced by the Yesso Matsu (*Abies Yesoensis*), which then becomes the most prominent tree, and in the mountains of the Porosiri range covers an estimated area of twenty square miles with heavy growth.

It is thus seen that all the elevated lands are heavily clothed with valuable timber, which under suitable regulations can never be exhausted. The valley land could be wholly denuded of its trees and yet leave an exhaustless supply in the mountains.

The distribution of the herbaceous plants is so general throughout the valley, and the observations have extended through such a limited range of latitude, that it would be useless to attempt the assignment of any definite limits. It has been generally observed, however, that all small plants disappear at but slight elevations. A few exceptions are found in the low foot-hills west of Sapporo, wherever but little bamboo is found, and on some of the steep mountain slopes to the north, where bamboo is seldom to be found. Wherever bamboo grows in considerable quantity, its growth is so dense as to exclude all plants except vines, which can climb out to the sunlight, or Senecio and similar plants of great stature.

The almost entire absence of small flowering plants after the middle of June seems to be owing to the very rapid growth of larger plants, which completely shade the ground beneath.

It has invariably been noticed that such plants as

Senecio palmatus, which commonly reaches a height of twelve feet, find their habitat in the damp soil of the bottom lands, suddenly disappearing as the land rises and the alluvium disappears.

Just below the mouth of the Otoshinai river on the left bank of the Ishcari, there appears a low ridge of drift formation rising some twenty feet above the level of the alluvial soil on each side. The vegetation of the latter soil consists almost wholly of *Senecio* and *Lumaria* without bamboo. The vegetation of the ridge is almost exclusively of bamboo, without either of the species first named.

The demarkation is as distinct as that between the soils.

The *Nardosmia Japonica* (Fuki) is worthy of special notice from the many ways in which it may be utilized. The young tender petioles of the leaves are largely used by the Japanese as food, and all through the summer furnish food for the many bears in the mountains. During July and August, the leaves reach a diameter of two or two and one half feet, while the petioles are often five feet in length. During the summer expedition, they often served a most useful end as umbrellas; and as temporary shingles for a camp they are not to be surpassed, throwing the rain perfectly or forming a cool retreat from the sun. Its distribution is very general in the low lands and is often common to an elevation of 2800 ft.

Owing to the scarcity of ponds or lakes, but few waterplants are to be met with. In the ponds at Urashinai are to be found *Potamogeton*, *Nymphea tetragona*, *Nuphar*, *Japonica*, and *Trapa natans*, the fruit of the latter being esteemed as an edible.

The most peculiarly attractive feature of the forests

throughout the plains, is to be found in the pendent vines, looking as if Nature had shaken her tresses loose, gaining beauty in the dishevelment.

Perhaps the most worthy of notice is the kokuwa, a species of *Actinidia*. The vine often attains a diameter of eight inches, and ascends trees to a great height, clothing their trunks and branches with rich, heavy foliage. As an ornamental vine, it is worthy of general introduction, both on account of its foliage and flowers, the latter being very abundant. The berries are large, of fine flavor when fully ripe, and undoubtedly susceptible of improvement by proper cultivation.

Two species of *Vitis* are found abundantly. *Vitis labrusca* often reaches a great size, and frequently grasps limbs of trees twenty to thirty feet above the ground, without intervening support. It would seem at first as if the vines grew up with the trees, but a closer examination shows from the comparative age of many that this cannot be true, but that they have generally ascended by the aid of low branches or small trees. The supports decaying and breaking down leave the vines curiously suspended, often at a distance of fifteen or twenty feet from the trunk of the tree.

The large grape vine measuring eleven inches in diameter, recorded by President Clark in the report for 1876-1877 has been rivalled by one discovered in California having a diameter of thirteen inches.

The second species of *Vitis* is known to the Japanese as blind grape (mekura budo), and though the fruit is small and worthless, the vine is valuable for ornamental purposes. *Ampelopsis*, *Ivy* and *Schizophragma* are also abundant, adding their rich foliage to the general forest wealth.

Mistletoe *(Viscum album)* is to be observed abundantly on the various species of oaks, often producing by its growth immense warts several feet in diameter. It is also common to the alder.

Lichens are to be found in but few localities, and then mostly at considerable elevation. *Peltigera rufescens* is found in the woods about Sapporo and, with poorly developed *Cladonia*, seems to constitute the sum of the lichens in the low lands. On the steep bluffs of the coast near Otarunai, various species of rock lichens are to be found at an elevation of two or three hundred feet.

On ascending the Mt. Tiene range, lichens appear at an elevation of about one thousand feet, and continue abundant to the summit, at an elevation of 3200 feet.

In ascending the high range of Porosiri, lichens were not met with until an elevation of about two thousand feet was reached, at the falls of the Ashibets river. At that place rock lichens were abundant though very few in kind.

GEOLOGICAL FEATURES.

Leaving the alluvial formation of the Ishicari valley and entering the Sorachi river, we soon find that, with a general rapid rise of the land, a markedly different and older formation is brought to view. Drift soil, deep at first, gradually thins out, disclosing a somewhat compact sandstone containing numerous fossils, which seem to indicate an old sea bottom.

This particular formation shows several strata exhibiting very different degrees of solidification, the

latter seeming to be due rather to some specific action in the different strata than to the effect of time, since a layer of crumbling softness would not unfrequently be succeeded by one of great hardness. The outcrop occurs at two localities from two to five miles from the mouth of the river, the dip being very gradual towards the mouth of the river, west. Shortly after passing these fossils, the appearance of shales containing fossil leaves and sedges, indicates an approach to the coal measures already well known from Mr. Lyman's survey.

From the Sorachi coal to the mouth of the Ashibets river, a distance of perhaps ten miles, the formation consists mostly of clay and sandstone shales containing fossils of sedges and leaves.

A few leaves of exogenous trees were found, but a pretty lengthy search failed to discover plants of more importance than sedges.

Within this section the upheaval was by no means uniform, as the varying strikes of the strata clearly show. Double terraces mark the high steep banks on each side, enclosing the river in somewhat of a deep gorge, which extends eastward to where the

Ashibets River

enters the Sorachi under the shadow of a bluff nearly one hundred feet high. For a distance of about eighteen miles the Ashibets river passes through a winding cañon from fifty to one hundred and fifty feet in height, which terminates in bold cliffs thirty-five feet high, between which the river pours in a beautiful torrent over a more gradual descent.

Within half a mile from the mouth of the river the first outcrop of coal is met with, and veins continually appear throughout the first fifteen miles of the

river course. The first seam of coal found was two feet in thickness, while farther up the river one of six and another of ten feet were found. Within the distance mentioned, twenty-seven distinct outcrops of coal were noticed. In point of size, however, they are all, with three exceptions, of no importance; the width of the exceptional strata being ten, six and two feet. In quality, it is very doubtful if any of the seams would be worth working, particularly while a superior coal can be obtained from the Sorachi and Poronai seams.

The chief value of the coal as found here is from a geological point of view. It certainly seems to indicate a somewhat more extended range of the coal measures than was indicated by previous surveys of the adjacent mountains.

The general strike of the formation is N. E. & S. W. A striking similarity is noticed between the shales of this region and those on the Ikushibets river. It seems highly probable that the coal here found is but a continuation of that found to the east and southeast. Supposing this view correct, there would then appear to be a considerable increase in coal area over the limits previously assigned.

Shales containing fossil plants are common so far as the coal extends.

At the point where the coal terminates, the river makes two right angles, passing through a cañon with vertical walls, for a distance of half a mile. The wall on the right approach is composed wholly of green sandstone, while that on the left, just above, is variable in composition, consisting of different grades of gray sandstone. Large, rounded boulders had previously been met with for a mile down the river, and

that this was their point of origin was clearly proved by their entire absence above the canon, and the presence at this point of huge blocks of stone that had fallen from the cliffs. Much of the stone found here would be quite valuable for building purposes, the only obstacles to its availability being distance and difficulty of obtaining good transportation routes.

No definite dip or stratification was to be detected in the rock masses at this point; but one mile above, and until the falls were reached, clay and sandstone shales were abundant, forming the bed of the river. The formation at the falls is wholly of greenish sandstone, superior in position to the clay shales of the river bed below, and inferior to the gray sandstone forming the entire river bed for a long distance above. The different strata have been broken away in such a manner that the water falls over a series of benches, in all forming a fall estimated at thirty-five feet.

The dip was here found to be 19°, strike S. 80° W. The general course of the face of the exposures of both clay and sandstone is S. 27° E, N 27° W. The indications of the barometer showed the falls to be at an elevation of 2200 ft. above sea level.

Above this point the stratified sandstone formation is visible for a long distance. At a point about fifteen miles from the falls, the river emerges from an impassible flume, the walls of which are about twenty-five feet apart,—falling over a vertical wall of ten feet. A reconnoisance of half a mile showed the place inaccessible. The formation at that point consists of unstratified sandstone, though it seems evident that there must be some stratified deposits beyond, as the occurrence of fragmentary fossil mollusks just below, without any formation in the vicinity from which they

could come, would seem to indicate.

The direction of the stream and a survey of the country from a neighboring mountain seemed to indicate that the original source of the river could not be far away, taking its rise on the western slope of the Porosiri range just north of Nirashi mountain, the flume being located at the foot of the slope.

The formation in the region of the upper Ikushibets river is strikingly similar to that in the Ashibets river valley, as indeed would rather be expected from the proximity of the two rivers.

The Ashibets, rising on the western slope of the Porosiri range, north of Nirashi, flows N. W. for a distance of about fifteen miles, and is then turned to the N. E. by N. by one of the foot ranges parallel with the main range. The Ikushibets river is believed to rise on the north-western slope of Porosiri Mountain, whence it flows to the N. W. parallel with the Ashibets, is finally turned to the west by the same range that turns the latter river on the other side to the north-east, and crosses the range not far from its termination. The Ikushibets river is further turned to the southwest by the front or lower range which terminates on the north side, so that the two rivers, at first not more than five miles apart, diverge until they empty at points about forty-five miles apart in a straight line.

The greatest elevation appears to be in the vicinity of Porasiri, from which the main range runs north and south, while parallel to the latter on the western slope are three ranges with a general direction N. E. by N., terminating in the vicinity of the Ikushibets on the south. The third range terminates some miles farther to the south.

With one or two exceptions, the formations in the vicinity of the Ikushibets river are similar to those of the Ashibets. Perhaps a greater variety in quality of sandstone is to be remarked, while the river action has not produced those deep gorges noticeable on the latter.

High banks of disintegrating clay-stone are to be found on both rivers; but peculiar to those of the Ikushibets are lime balls of all sizes, from a robin's egg to three feet in diameter, containing nuclei of clams, fossil wood or even smaller stones. A qualitative analysis shows them to consist mainly of carbonate of lime, with which is mixed a considerable proportion — possibly one-fourth—of silicate of alumina (clay).

The last coal outcrops of importance are seen about five ri (or 12 ½ miles) from Poronaibuto; the appearance of coal is found about five ri (12 ½ miles) beyond, twenty-five miles from Poronaibuto, in a small stream flowing from the westward. Fossils are abundant in the formations of the Ikushibets river, in the vicinity of the coal. Fossil bivalves are numerous. In the clay and sandstone shales at the Poronai coal mine, are found many interesting fossils consisting of leaves of exogens, sedges, ferns, &c.

The whole bottom of the lower Ikushibets, in the vicinity of the Horomui river, consists of a very interesting peat formation which is regulary stratified, each stratum being again susceptible of separation into other strata from one to several inches in thickness. The mass seems to be composed largely of the roots of ferns and similar plants, the softer cellular parts having decayed away. Moist, it is yielding but easily cut with an axe or other instruments; dry, it is hard and brittle.

RIVERS.

As is already well known, the Ishcari river affords fine facilities for communication with the lands of the upper valley by means of small river steamers, which could easily navigate as far as the Sorachi river. Its tributaries between the Ikushibets and Sorachi rivers are all of small size, being in reality no more than large brooks, and it is doubtful if they can ever, with one or two exceptions—where they could be used to float lumber down during flood—be of use beyond giving drainage to the adjacent land, and in this connection they would undoubtedly serve a most important purpose.

The rapid ascent, and consequently numerous rapids, will always serve as a barrier to the navigation of the Sorachi by more than boats of very light draught, and even with them there will be considerable difficulty when the water is low.

The first tributary of the Sorachi that can command the name of river is the Ashibets, which is truly a mountain torrent, subject to all the rapid and varied fluctuations of water level, irregularity of course, and numerous rapids and falls, peculiar to a river rising in high mountains and finding its course among the same with rapid descent. The amount of water flowing during the summer is comparatively small, the river being fordable almost at all points; but from water marks, it is evident that the melting snows of spring cause the water to rise to a considerable elevation.

As an outlet for the vast amount of timber in its vicinity, the Ashibets river can be made to serve an important purpose.

The Ikushibets river does not exhibit that rapid

rise, even after entering the mountains, observable in the Ashibets, but being a mountain stream is subject to the same fluctuations. The most marked peculiarity of this river is in the almost innumerable number of fallen trees that obstruct navigation, and through which it was sometimes necessary to saw and chop a way for the boats.

The frequent appearance of large trees protruding from the banks under a deposit of ten feet of alluvium afforded evidence of the antiquity of the process apparently in operation at present, and suggested a thought as to the age of some of the prostrate monarchs of the forest.

The Ikushibets river is by no means an exception in the obstructions found, otherwise than in the number.

The Ishcari river contains many water-logged trees, which, covered by the water, render navigation dangerous. All its tributaries so far as observed are obstructed similarly, and, as many trees annually fall into the river by washing out of the banks, navigation must always be obstructed until the timber is felled for a considerable distance back from the banks.

Navigation, limited as it is, entirely ceases at the Poronai river, at which point, also, all the obstructions in the shape of trees disappear.

The exceedingly limited navigation, more than which the Ikushibets river could not afford at best, will probably never be sufficient inducement to undertake the expensive operation of clearing the channel. Insufficiency of water would be a continual annoyance.

The constant tendency of the rivers to straighten is well seen at the sharper curves of the Ishcari, where the river sometimes reverses its course. Two islands

have been formed during the past two years by the gradual washing away of the narrow divide. At Bibai, the river is thus shortened about two miles and one-half, and again at T'Kapusetocie about two miles. Islands will probably be formed in a similar manner during the next few years at two places farther down, where two points, nearly three miles apart by the river, approach so closely as to be seen one from the other, a distance of a few hundred yards only.

The sensitiveness of the rivers to a rainfall in the mountains was well shown by a few observations. While at the falls of the Ashibets river, a heavy shower, passing over, about five miles up the river, so increased the flow of water that in two hours the amount passing over the falls was very perceptibly increased.

On entering the Ishcari river from the Sorachi, it was found that the rain of the two previous days had brought the river up to a high level. In four days the water fell nearly five feet, with continued decrease during the fifth day.

An interesting formation is to be observed in some of the high bluffs between Jenibako and Otarunai. The face of a vertical bluff, two or three hundred feet high, presents a regular well defined crystalline structure. On inspection it is seen that the crystals extend vertically from the base, to a point near the top of the bluff, where they rapidly approach a common centre. Other short, apparently fragmentary crystals approach the same centre from the sides and top. The whole appearance is strikingly similar to that of iron sand on glass, when brought over the poles of a magnet, the longer crystals forming, as it were, the connection between the poles.

SOIL AND DRAINAGE.

From as many distinct localities, nine soils have been collected for specimens and analysis. Reference to the accompanying table will show the general character of each and the vegetation.

The land on each side of the Ishcari river, extending from it a distance of one to four miles, consists of new alluvium, undoubtedly capable of yielding large returns in crops, as the natural vegetation indicates. For the greater part, the surface consists of semi-swamps covered with a very heavy growth of grass, that commonly attains to a height of eight or ten feet. With considerable elevation above the general level of the river, a rather rapid rise towards the mountains, and being crossed by numerous small streams, the land would seem susceptible of good drainage.

Along the banks of the lower river, the alluvium is very deep, but gradually grows more shallow in the upper valley until, at the mouth of the Sorachi river, it is but a few feet in thickness.

A large amount of iron is to be found in all the soils of the section visited, its presence being strikingly indicated by the appearance of the river banks and the water draining from the land, which would often be of a deep red, coloring the surrounding water into which it flowed, for a considerable distance.

While the character of the soil renders the Ishcari valley a most valuable agricultural district, the river, a natural highway offering easy access to the adjacent land, greatly enhances the value of the latter by supplying a ready means of transportation.

In the valley of the Ikushibets river, the land on each side soon rises into low foot-hills and easy slopes

with comparatively little bamboo, offering good advantages for grazing the cattle of the farms bordered on the other side by the river.

The same is probably true of all the low hills from the Ikushibets to the Sorachi river. After the Ikushibets river crosses the first range of foot-hills, there is no land suitable for more than very limited farming operations, since it rises rapidly on each side into mountains.

In the valley of the Sorachi, there is much of the land available for general agriculture, though its elevation and rolling character would probably render it more available for stock than any thing else.

The valley of the Ashibets river is wholly impracticable for farming operations, both on account of the nature of the land and facilities for transportation. The section of mountain lands it traverses, however, must ever be valuable timber land, if the growth is not destroyed by reckless felling.

ANIMALS &c.

When ascending both the Ashibets and Ikushibets rivers, large numbers of fish were seen in the numerous pools or leaping the falls. They are known by the Japanese name of masu, which however is rather a generic term, and appear to be a species of salmon different from those taken during the fall fishing at Ishcari. Great numbers were seen leaping the falls of the Ashibets river, where fourteen fine ones were captured in less than half an hour, and they were also found abundantly in all the pools above the falls. The Ikushibets river is also well stocked with fish,

and from the accounts of the Ainos it would seem that the headwaters of the Sorachi, where the men go to fish every year at the falls, furnish a large supply.

On descending the Ishcari river about the first of August, the Ainos were seen busily engaged in taking fish, large numbers of which they capture with small nets. Those seemed to be the first of the fall salmon on their way to the spawning beds.

Of the number of fish taken yearly at the falls of the various rivers nothing definite could be learned from the Ainos, but the number seems to be large.

Of animals, bears seem to be both numerous and large, but are apparently very shy. On one occasion a bear entered camp during the night and passed by the open tent where were several sleepers, but finally made off without offering any trouble.

An incident of late occurrence, however, demonstrates that the bears of Hokkaido are capable of committing serious depredations. A large brown bear entered a house at night, within three miles of Sapporo, and attacked a sleeping man, who was very dangerously wounded. The animal had previously devoured a small child as well as a full grown man, the remains of whom were found in the woods during the pursuit which followed. Finally found and killed, the bear was brought to Sapporo and stuffed for a museum specimen, while an examination of the body and stomach showed some interesting facts.

The first noticeable feature was the entire absence of fat. Either his hibernation must have been interrupted in some unusual manner, or he did not enter into it at all; and in either case, his fast must have been long, owing to the amount of snow on the

ground and consequent difficulty of obtaining food. Excessive hunger, therefore, undoubtedly drove him to the unusual attacks recorded.

The body measured from tail to crown of head, five feet ten inches. The brain was carefully extracted and found to weigh 13.7 oz.

An examination of the stomach showed the horrible nature of his last meal, and the condition of the contents showed, first, that the bear does not masticate his food much or any, since nearly all the contents, not destroyed by the digestive processes, showed no signs whatever of mastication; second, that the digestive process is slow, food, known to have been eaten twelve hours previously, showing but little digestive action, the form and general character being well preserved to such an extent that all parts were distinctly recognized. Food known to have been eaten some time previously was in a very advanced stage of digestion.

It is customary among the Ainos to catch the bears when very young, confine them in cages until quite large, and then kill them with many ceremonies, which conclude by voting the fortunate hunter a "great man."

The peculiar boldness of the animal noted has been ascribed by some to the supposed fact that he had originally been kept by the Ainos and had escaped; but as facts are wanting to support such a supposition, it seems rather more probable that excessive hunger was the immediate cause.

Deer are also very numerous, and could often be heard about the camp at night. The track of a wolf was followed for a distance, to a place where it had left a half-devoured deer but a short time before. The track showed the animal to be of large size, and it is

known among the Ainos as mountain wolf.

The principal birds of the forest seem to be the cuckoo, wild pigeon, nightingale, jay, and gray eagle, several of which were to be seen in the mountains.

With these exceptions, birds seem to be rather generally conspicuous for their absence. All the small streams and the ponds at Urashinai abound in ducks, of which there seem to be four species at least.

Vipers measuring about two feet in length seem to be abundant. Nineteen were seen, of which fifteen were killed. None of them exhibited any inclination to bite except when irritated.

AINOS.

Very few Ainos are to be met with after leaving the Chitocie river. An occasional house, occupied only during the fishing season, may be seen in the vicinity of the Osakanai river, while farther to the north permanent abodes are to be met with, the chief settlement being at the mouth of the Sorachi river. From accounts obtained from the chief of the Sorachi Ainos, it would seem that there are about twenty families under his jurisdiction.

With no resources except those provided by nature, and without any apparent effort towards bettering their condition, their time is spent in searching the forests for game, or collecting such material as their limited intercourse with the Japanese will render of pecuniary value. Their food consists of venison, fish, and lily bulbs, to which berries are added in their season. It would seem that all the wild lilies having any considerable bulb are utilized for food.

After gathering, the bulbs are pounded in a wood-

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